Vol. 14, No. 17
September 15, 1989

Energy Research Abstracts

Abstracts 35511-37824

Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

The Office of Scientific and Technical Information

The Department of Energy's Scientific and Technical Information Program (STIP) is carried out at many levels within the Department and by its contractor organizations. The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, provides direction and leadership for STIP and serves as DOE's national center for scientific and technical information management and dissemination. Both DOE-originated information and worldwide literature regarding advances in subjects of interest to DOE researchers are collected, processed, and disseminated through the Energy Data Information System (EDIS) maintained by OSTI. The major data bases in this system are available within the United States through commercial on-line systems and to those outside the United States through formal governmental exchange agreements. The current-year records for the major data bases plus a number of specialized data bases are available to DOE offices and contractors through OSTI's Integrated Technical Information System (ITIS). To manage DOE's information resources effectively, DOE's Scientific and Technical Information Program is one of continual development and evaluation of new information products, systems, and technologies.

UNITED STATES DEPARTMENT OF ENERGY
Office of Scientific and Technical Information
Post Office Box 62
Oak Ridge, Tennessee 37831

International Copyright, © U.S. Department of Energy, 1989, under the provisions of the Universal Copyright Convention.
United States copyright is not asserted under the United States Copyright Law, Title 17, United States Code.

Vol. 14, No. 17
September 15, 1989
ISSN: 0160-3604
CODEN: ERABD

Energy Research Abstracts

Purpose

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U.S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. Foreign information is obtained through the International Energy Agency's 13-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. **Please note that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.**

Scope

ERA is comprehensive in its subject scope, encompassing DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

The citations presented in *ERA* are available for on-line searching as records within the Energy Data Base. The current-year records are available on the Integrated Technical Information System (ITIS). The entire data base is available through commercial on-line vendors.

Availability

DOE and DOE contractors who have OSTI deposit accounts can obtain *ERA* (regular issues and annual indexes) from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831, Attention: Information Services. For further information, call (615)576-8401, FTS 626-8401. *ERA* is also available at authorized GPO Depository Libraries. (List is provided on the inside back cover.)

ERA is available to the public on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The subscription rate for 24 semimonthly issues is $184.00 for domestic subscribers and $230.00 for foreign subscribers. A single issue costs $27.00, domestic, or $33.75, foreign. Cumulative indexes are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The GPO Stock Number is 661-000-00000-7 and the price is $174.00 for the Volume 13 indexes.

Managing Editor, Audrey B. Smith
Technical Editor, M. Catherine Grissom

Information Sources

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

The **Energy Technology Data Exchange (ETDE)** was established by the International Energy Agency to promote cooperation among members in conducting appropriate energy-related research and development programs through the development of a formal central information sharing system. In accomplishing the objectives of the ETDE, members select, abstract, and index relevant research information published in their countries in accordance with Exchange standards. OSTI serves as the central receiving and processing center for this information, which it then disseminates to national centers in the participating countries. The following countries are currently members of the ETDE:

Canada	Japan
Denmark	The Netherlands
Finland	Norway
France	Spain
Federal Republic of Germany	Sweden
Italy	United Kingdom
	United States

The **International Nuclear Information System (INIS)** was established to promote the exchange of information on nuclear science and technology. Its operation is similar to that of the ETDE, with the INIS Secretariat being located in Vienna, Austria. Currently, 75 countries and 14 international organizations are members of INIS. OSTI serves as the INIS national center for the United States.

In the exercise of its rights and responsibilities under the agreements to which it is a party, the **Office of Scientific and Technical Information** both receives information from the above sources and submits U.S.-produced information to them. In addition to materials generated by the Department of Energy, this U.S.-produced information is gathered from other government agencies as well as under contract with private information processing companies. All input is computer processed and entered into a data base for on-line retrieval. The data base serves as well for the production of numerous OSTI publications.

How To Read A Citation

The coverage of literature in this publication includes several document types, ranging from technical reports to journal articles to books. The principal data elements included in these citations are:

1. **Abstract number** within volume.
2. **Report number** identification for report-type literature.
3. **Title and subtitle** (non-English title may appear in parentheses, if applicable).
4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
6. **Collaboration,** if present.
7. **Corporate author(s)** identifying corporation responsible for document.
8. **Patent assignee and number** for citations of patent documents or applications.
9. **Journal title, volume, and issue** for citations of journal articles.
10. **Date of publication.** If not known, a processing date is in brackets.
11. **Number of pages** or page range.
12. **Language** of document if non-English.
13. **Monograph title** if citation is an analytic (part, chapter, or paper) of a larger monograph.
14. **Publisher's name and location** for documents published by a corporate or commercial source.
15. **Sponsoring organization.**
16. **Contract or grant number.**
17. **Secondary identifying number;** may be a conference number.
18. **Conference title, location, and date,** if applicable.
19. **Order number.** The "DE" order number may be used for ordering from NTIS or OSTI, as appropriate. The "TI" prefix is valid only at OSTI.
20. **Sources of availability** from which a copy of the document may be obtained; usually appear as abbreviations. (See information on following page.)
21. **Drop note** or explanatory statement.
22. **Abstract.**
23. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations

Report

18494 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89780060/JAW. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

Journal Article

19055 **A theoretical and experimental investigation of long-pulse, electron-beam-produced rare gas plasmas.** Brake, M.L.; Repetti, T.E. (Energy Beam Interaction Lab. of the Dept. of Nuclear Engineering, Univ. of Michigan, Ann Arbor, MI (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA),* 16(5): 581-589 (Oct 1988). (CONF-881020–: Symposium on radiation physics, Sao Paulo, Brazil, October 3, 1988).

Visible emission spectroscopy (380-650 nm) has been performed on intense, electron beam (1 kA, 300 ns, 300 kV) produced Ar, Kr,...

Patent

18045 **Polarization of fast particle beams by collisional pumping.** Stearns, J.W. To Dept. of Energy, Washington, DC. USA Patent 4,724,117. 9 Feb 1988. Filed date 19 Oct 1984. vp. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

A method for polarizing a fast beam of particles by collisional pumping, comprising the steps of generating a beam...

How To Order from the Availability Sources

TO OBTAIN A REPORT

Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 20 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) The public should order from NTIS or from one of the other agencies listed in the citation. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

GPO Superintendent of Documents
Government Printing Office
Washington, DC 20402

GPO Dep. Available for inspection or interlibrary loan at Government Printing Office regional depository libraries.

INIS *Available only in microfiche.*
INIS Clearinghouse
International Atomic Energy Agency
P.O. Box 100, A-1400
Vienna, Austria

NTIS U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

OSTI U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

TO OBTAIN NON-REPORT LITERATURE

Nonreport literature generally is available from the commercial publisher or corporation listed in the citation. These documents may also be available for loan from local libraries. First, check with the local library. Other sources of information are:

Journal articles *Chemical Abstracts Service Source Index (CASSI)* tells which libraries, both U.S. and foreign, contain a journal and the available years. *Ulrich's International Periodicals Directory* contains information on the journal and its publisher. For librarians, another source of information is On-Line Computer Library Center (OCLC), for interlibrary loans.

Books, conferences, and monographs The source for these publications is the publisher or the originating society, organization, or institution. DOE-supported conferences and individual papers reporting DOE-supported research may be available as reports from OSTI.

Foreign material The Linda Hall Library is an excellent source of foreign materials. For translations of foreign language material, contact the John Crerar Library. For material difficult to locate, check with the British Library Document Supply Centre.

On-Line Computer Library Center
6565 Frantz Road
Dublin, OH 43107-0702
614-764-6000

Linda Hall Library
5109 Cherry Street
Kansas City, MO 64110
816-363-4600

John Crerar Library
University of Chicago
5730 S. Ellis
Chicago, IL 60637
312-962-7715

British Library Document Supply Centre
Boston Spa, Weatherby
West Yorkshire
LS23 7BQ
United Kingdom

How To Use the Indexes

Five indexes are provided for approaching the content of each issue of *Energy Research Abstracts*. Descriptions of entries in these indexes follow.

Corporate Author Index
The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the "Report" sample citation would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 14:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 14:18255 (R;US)

Personal Author Index
Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 14:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 14:18494 (R;US)

Subject Index
This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

HYDROGEN ISOTOPES
See also DEUTERIUM
HYDROGEN 4
TRITIUM
Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 14:18686 (RA;SU;In Russian)

Contract Number Index
DOE technical reports are listed by contract number. Each entry also provides the primary corporation or organization cited for that contract number. A typical entry is shown.

FG02-88ER40438 **Wisconsin Univ., Madison (USA). Dept. of Physics**
14:18494 DOE/ER/40438–T1
FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**
14:17641 DOE/ER/60664–1

Report Number Index
Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438–T1 14:18494 NTIS, PC A03/MF A01 - OSTI E 1.99: DE89007246/JAW MF-411

Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the data base records.* The following list includes all of the 40 first-level and the 289 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

Numerical Listing of Categories

01 COAL AND COAL PRODUCTS
- 03 Preparation
- 04 Processing
- 05 By-Products
- 06 Properties
- 08 Waste Management
- 09 Environmental Aspects
- 10 Reserves and Exploration
- 20 Mining
- 30 Transport and Handling
- 40 Combustion
- 50 Marketing and Economics
- 60 Health and Safety
- 70 Legislation and Regulations

02 PETROLEUM
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling and Production
- 04 Processing
- 05 Products and By-Products
- 06 Health and Safety
- 07 Marketing and Economics
- 08 Waste Management
- 09 Environmental Aspects
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Storage
- 50 Combustion

03 NATURAL GAS
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling, Production, and Processing
- 04 Products and By-Products
- 05 Health and Safety
- 06 Marketing and Economics
- 07 Waste Management
- 08 Environmental Aspects
- 09 Artificial Stimulation
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Combustion
- 50 Storage

04 OIL SHALES AND TAR SANDS
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 03 Drilling, Fracturing, and Mining
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 06 Direct Uses and By-Products
- 07 Health and Safety
- 08 Marketing and Economics
- 09 Waste Research and Management
- 10 Environmental Aspects
- 20 Regulations

05 NUCLEAR FUELS
- 01 Reserves, Exploration, and Mining
- 04 Feed Processing
- 05 Uranium Enrichment
- 07 Fuels Production and Properties
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 10 Marketing, Economics, and By-Products
- 20 Waste Management
- 30 Environmental Aspects
- 40 Health and Safety
- 50 Safeguards, Inspection, and Accountability
- 60 Legislation and Regulations

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 01 Physical Isotope Separation
- 02 Radiation Sources
- 03 Isotopic Power Supplies
- 04 Economics

08 HYDROGEN
- 01 Production
- 02 Storage
- 03 Transport
- 04 Marketing and Economics
- 05 Safety
- 06 Industrial and Commercial Use
- 07 By-Products
- 08 Properties
- 09 Environmental Aspects

09 OTHER SYNTHETIC AND NATURAL FUELS
- 01 Hydrocarbon Fuels
- 02 Alcohol Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 04 Solid Waste and Wood Fuels
- 05 Liquid Waste Fuels
- 06 Gaseous Waste Fuels

13 HYDRO ENERGY
- 01 Resources and Availability
- 02 Site Geology and Meteorology
- 03 Plant Design and Operation
- 04 Regulations and Licensing
- 05 Economics and Management
- 06 Environmental Aspects
- 07 Power-Conversion Systems

14 SOLAR ENERGY
- 01 Resources and Availability
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 05 Solar Energy Conversion
- 06 Photovoltaic Power Systems
- 07 Solar Thermal Power Systems
- 08 Ocean Energy Systems
- 09 Solar Thermal Utilization
- 10 Solar Collectors and Concentrators
- 20 Heat Storage

15 GEOTHERMAL ENERGY
- 01 Resource Status and Assessment
- 02 Geology and Hydrology of Geothermal Systems
- 03 Geothermal Exploration and Exploration Technology
- 04 Legal and Institutional Aspects

*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in DOE/TIC-4584, *Energy Data Base: Subject Categories and Scope.*

05 Economic and Financial Aspects
06 Environmental Aspects and Waste Disposal
07 By-Products
08 Geothermal Power Plants
09 Geothermal Engineering
10 Direct Energy Utilization
20 Geothermal Data and Theory

16 TIDAL AND WAVE POWER
03 Regulations
04 Economics
05 Environmental Aspects
07 Tidal Power Plants
08 Wave Energy Converters

17 WIND ENERGY
01 Availability (C'imatology)
03 Regulations
04 Economics
05 Environmental Aspects
06 Wind Energy Engineering

20 ELECTRIC POWER ENGINEERING
01 Power Plants and Power Generation
02 Environmental Control Technology
03 Power Transmission and Distribution

21 NUCLEAR POWER PLANTS
01 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled
02 Power Reactors, Nonbreeding, Light-Water Moderated, Non-boiling Water Cooled
03 Power Reactors, Nonbreeding, Graphite Moderated
04 Power Reactors, Nonbreeding, Otherwise Moderated or Unmoderated
05 Power Reactors, Breeding
06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
07 Regulation and Licensing
08 Economics

22 NUCLEAR REACTOR TECHNOLOGY
01 Theory and Calculation
02 Components and Accessories
03 Fuel Elements
04 Control Systems
05 Environmental Aspects
06 Research, Test, and Experimental Reactors
07 Plutonium and Isotope Production Reactors
08 Propulsion Reactors
09 Reactor Safety

25 ENERGY STORAGE
01 Magnetic
02 Compressed Gas
03 Pumped Hydro
04 Capacitor Banks
05 Flywheels
06 Thermal
07 Liquefied Gas
08 Chemical
09 Batteries

29 ENERGY PLANNING AND POLICY
01 Energy Analysis and Modeling
02 Economics and Sociology
03 Environment, Health, and Safety
04 Natural Resources
05 Research, Development, Demonstration, and Commercialization
06 Nuclear Energy
07 Transport and Storage
08 Waste Heat Utilization
10 Conservation
20 Supply, Demand, and Forecasting
30 Policy, Legislation, and Regulation
40 Fossil Fuels
50 Hydrogen and Synthetic Fuels
60 Electric Power
80 Consumption and Utilization
90 Unconventional Sources and Power Generation

30 DIRECT ENERGY CONVERSION
01 MHD Generators
02 EHD Generators
03 Thermoelectric Generators
04 Thermionic Converters
05 Fuel Cells
08 Miscellaneous Converters

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
01 Buildings
02 Transportation
03 Industry and Agriculture
06 Municipalities and Community Systems
09 Education and Public Relations

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
01 Internal Combustion Engines
02 External Combustion Engines
03 Electric-Powered Systems
04 Hybrid Systems
05 Flywheel Propulsion
06 Vehicle Design Factors
07 Emission Control
08 Alternative Fuels

35 ARMS CONTROL
01 Policy, Negotiations, and Legislation
02 Proliferation
03 Verification

36 MATERIALS
01 Metals and Alloys
02 Ceramics, Cermets, and Refractories
06 Other Materials

40 CHEMISTRY
01 Analytical and Separations Chemistry
02 Inorganic, Organic, and Physical Chemistry
04 Electrochemistry
05 Photochemistry
06 Radiation Chemistry
07 Radiochemistry and Nuclear Chemistry
08 Combustion, Pyrolysis, and High-Temperature Chemistry

42 ENGINEERING
02 Facilities and Equipment
03 Lasers
04 Heat Transfer and Fluid Flow
05 Materials Testing
08 Electronic Circuits and Devices
09 Waste Processing Plants and Equipment
10 Combustion Systems
20 Underground Engineering
30 Marine Engineering
40 Pollution Control Equipment
50 Power Cycles

43 PARTICLE ACCELERATORS
01 Design, Development, and Operation
02 Beam Dynamics, Field Calculations, and Ion Optics
03 Auxiliaries and Components
04 Storage Rings

44 INSTRUMENTATION
01 Radiation Instrumentation
02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
03 Miscellaneous Instruments
04 Well Logging Instrumentation

45 EXPLOSIONS AND EXPLOSIVES
01 Chemical
02 Nuclear
03 Explosion Detection

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
01 Basic Studies
02 Chemicals Monitoring and Transport
03 Radioactive Materials Monitoring and Transport
04 Thermal Effluents Monitoring and Transport
05 Site Resource and Use Studies
06 Regulations

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

52 ENVIRONMENTAL SCIENCES, AQUATIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 01 Social and Economic Studies
- 02 Assessment of Energy Technologies

55 BIOMEDICAL SCIENCES, BASIC STUDIES
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology
- 04 Genetics
- 05 Metabolism
- 06 Medicine
- 07 Microbiology
- 08 Morphology
- 09 Pathology
- 10 Physiological Systems
- 20 Public Health
- 30 Agriculture and Food Technology

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
- 01 Radiation Effects
- 02 Thermal Effects
- 03 Chemicals Metabolism and Toxicology
- 04 Other Environmental Pollutant Effects

57 HEALTH AND SAFETY

58 GEOSCIENCES
- 01 Geology and Hydrology
- 02 Geophysics
- 03 Mineralogy, Petrology, and Rock Mechanics
- 04 Geochemistry
- 05 Oceanography

64 PHYSICS I
- 01 Astrophysics and Cosmology
- 02 Atmospheric Physics
- 03 Atomic, Molecular, and Chemical Physics
- 04 Fluid Physics
- 50 High Energy Physics

65 PHYSICS II
- 10 Nuclear Physics
- 12-20 Nuclear Properties and Reactions
- 30 Nuclear Theory
- 40 Radiation and Shielding Physics
- 50 Medical Physics
- 60 Condensed Matter Physics
- 61 Superconductivity
- 70 Theoretical and Mathematical Physics

70 FUSION ENERGY
- 01 Plasma Research
- 02 Fusion Power Plant Technology

99 GENERAL AND MISCELLANEOUS
- 01 Management
- 02 Mathematics and Computers
- 03 Information Handling
- 04 Law
- 05 Civilian Defense

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

ORDER NUMBER CORRELATION

Alphabetical Listing of Categories

- 33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
- 35 ARMS CONTROL
- 56 BIOMEDICAL SCIENCES, APPLIED STUDIES
- 55 BIOMEDICAL SCIENCES, BASIC STUDIES
- 40 CHEMISTRY
- 01 COAL AND COAL PRODUCTS
- 30 DIRECT ENERGY CONVERSION
- 20 ELECTRIC POWER ENGINEERING
- 32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
- 29 ENERGY PLANNING AND POLICY
- 25 ENERGY STORAGE
- 42 ENGINEERING
- 52 ENVIRONMENTAL SCIENCES, AQUATIC
- 50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
- 51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 45 EXPLOSIONS AND EXPLOSIVES
- 70 FUSION ENERGY
- 99 GENERAL AND MISCELLANEOUS
- 58 GEOSCIENCES
- 15 GEOTHERMAL ENERGY
- 57 HEALTH AND SAFETY
- 13 HYDRO ENERGY
- 08 HYDROGEN
- 44 INSTRUMENTATION
- 07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 36 MATERIALS
- 03 NATURAL GAS
- 05 NUCLEAR FUELS
- 21 NUCLEAR POWER PLANTS
- 22 NUCLEAR REACTOR TECHNOLOGY
- 04 OIL SHALES AND TAR SANDS
- 09 OTHER SYNTHETIC AND NATURAL FUELS
- 43 PARTICLE ACCELERATORS
- 02 PETROLEUM
- 64 PHYSICS I
- 65 PHYSICS II
- 14 SOLAR ENERGY
- 16 TIDAL AND WAVE POWER
- 17 WIND ENERGY

Energy Research Abstracts

01 COAL AND COAL PRODUCTS

0103 Preparation

Refer also to citation(s) 35565

35511 (DOE/PC/88875–T1) **[Advanced froth flotation techniques]: Quarterly technical progress report No. 1, September 1, 1988–November 30, 1988.** Kaiser Engineers, Inc., Pittsburgh, PA (USA). 1988. 4p. Sponsored by DOE Fossil Energy. DOE Contract FG22-88PC88875. Order Number DE89014662/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The testing of advanced froth flotation techniques of coal from Ohio coal seams was started. Initial results on sulfur reduction of Meigs Creek coal are presented. (CBS)

35512 (DOE/PC/88875–T2) **Testing of pyrite flotation techniques on selected Ohio coals: Final report.** Arnold, B.J.; Torak, E.R. Kaiser Engineers, Inc., Pittsburgh, PA (USA). May 1989. 364p. Sponsored by DOE Fossil Energy. DOE Contract FG22-88PC88875. Order Number DE89014664/JAW. Available from NTIS, PC A16/MF A01 - OSTI.

The project was conceived to demonstrate the combining of conventional physical coal cleaning with emerging advanced physical coal cleaning technologies in a cost-effective manner. The objectives of the program were to demonstrate that conventional coal cleaning followed by advanced coal cleaning of a crushed mid-gravity portion of the run-of-mine coal would produce a clean coal, suitable for use as a thermal coal, having a lower ash content and a lower sulfur dioxide emission potential than a coal cleaned only be current conventional cleaning technologies. As part of this program a number of advanced flotation techniques were tested to determine the feasibility of including them in the design of their Advanced Coal Preparation Facility. The program consisted of testing the Pittsburgh seam, the Middle Kittanning seam, and the Meigs Creek seam coals in the pilot flotation circuit at EPRI's Coal Quality Development Center (CQDC) in Homer City, Pennsylvania. This report contains all the data from OCDO's pilot flotation test program at the CQDC and the test data from the Middle Kittanning and Meigs Creek reverse flotation tests. 13 figs., 40 tabs.

35513 (DOE/PC/88886–T2) **Development of an advanced process for drying fine coal in an inclined fluidized bed: Technical progress report for the second quarter, January 19–March 31, 1989.** Boysen, J.E.; Cha, C.Y.; Berggren, M.H.; Jha, M.C. Western Research Inst., Laramie, WY (USA); AMAX Research and Development Center, Golden, CO (USA). May 1989. 34p. Sponsored by DOE Fossil Energy. DOE Contract AC22-88PC88886. Order Number DE89013514/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This research project is for the development of a technically and economically feasible process for drying and stabilizing of fine particles of high-moisture subbituminous coal. Research activities were initiated with efforts concentrating on characterization of the two feed coals: Eagle Butte coal from AMAX Coal Company's mine located in the Powder River Basin of Wyoming; and coal from Usibelli Coal Mine, Inc.'s mine located in central Alaska. Both of the feed coals are high-moisture subbituminous coals with "as received" moisture contents of 29% and 22% for the Eagle Butte and Usibelli coals, respectively. However, physical analyses of the crushed coal samples (–28-mesh particle size range) indicate many differences. The minimum fluidization velocity (MFV) of the feed coals were experimentally determined. The MFV for –28-mesh Eagle Butte coal is approximately 1 ft/min, and the MFV for –28-mesh Usibelli coal is approximately 3 ft/min. 2 refs., 16 figs., 3 tabs.

35514 (DOE/PC/91271–T22) **Coal disintegration by high-pressure waterjet: Final report.** Mazurkiewicz, M. Missouri Univ., Rolla, MO (USA). Rock Mechanics and Explosives Research Center. Dec 1988. 144p. Sponsored by DOE Fossil Energy. DOE Contract AC22-86PC91271. Order Number DE89009795/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

A data base was constructed to demonstrate the capability and mechanism of coal comminution by means of high-pressure waterjets. With the aid of the data base, two laboratory-scale grinding mills were designed, constructed, tested, and evaluated for the production of sub-75-micron coal particles. One of the mills, a rotating-disk mill with one fixed waterjet, showed promise for significant efficiency. 11 refs., 85 figs., 27 tabs.

35515 (PB–89-162366/XAB) **Oil phase in selective agglomeration: a structural approach.** Labuschagne, B.C.J. National Inst. for Coal Research, Pretoria (South Africa). 1986. 37p. Available from NTIS, PC EE05/MF E05.

North American Continent sales only.

The 'structural approach' provides a method for determining the semi-quantitative contribution of physical and chemical properties on specific agglomeration aspects for coals within a certain hydrophobic range, which could be compared with results obtained for coals with different surface properties. Thus, by using properly selected bridging liquids such as individual members of an homologous series, different classes of compounds, and binary mixtures of known composition, the contribution of specific oil parameters (physical constants, chemical properties, structural aspects) on specific aspects of the spherical agglomeration process for fine coal (e.g., agglomeration time, agglomerate strength, final agglomerate size, percentage deashing, and organic recovery) can be determined or evaluated.

35516 (SP–87-11E) **Canadian coal preparation process-control research and development directions.** Salama, Ahmed, I.A. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). 1988. 69p. Available from Canadian Government Publishing Centre, Ottawa, ON, K1A 0S9 CANMET, 55 Booth St., Ottawa, Ontario, Canada K1A 0G1.

In response to the reduced world demand for coal, the coal industry has been challenged to optimize its operations and reduce the cost of production. In this paper the author, under the auspices of CANMET, conducted an industry survey and field visits to determine coal industry interest in process control development and priorities regarding specific plant circuits. This document evaluates the results of the survey, focuses on the on-line process control and instrumentation applications, and identifies future directions for research and development. 49 refs., 12 tabs., 7 figs.

0104 Processing

Refer also to citation(s) 35547, 35558, 35560, 35565, 35641

35517 (ACERR–1982) **Alberta Research Council [research reports-1982].** Alberta/Canada Energy Resources Research Fund, Edmonton, AB (Canada). 1982. vp. (CONF-8210362–: 32. Canadian chemical engineering conference, Vancouver, Canada, 3-6 Oct 1982;CE–02652). Available from Alberta Energy and Natural Resources, Information Centre, 9920-108 St., Edmonton, AB, Canada T5K 2M4; $N/C.

A series of research reports were compiled and presented at a conference on chemical engineering in Canada. These reports were authorized by the Coal Research Department of the Alberta Research Council and covered various aspects of liquefaction, pyrolysis and combustion of alberta subbituminous coals. Separate abstracts have been prepared for three papers presented in this series.

35518 (ACERR–1989, pp. 8) **Investigation in the use of heavy oils (and derivatives) to process coal.** Moschopedis, S.E. (Alberta Research Council, Edmonton, AB, Canada); Hawkins, R.W.; Speight, J.G. Alberta/Canada Energy Resources Research Fund, Edmonton, AB (Canada). [1989]. (CE–02653). In *Alberta Research Council [research reports].* Available from Alberta Energy

and Natural Resources, Information Centre, 9920-108 St., Edmonton, AB, Canada T5K 2M4; $N/C.

This study reports the effect of process parameters such as temperature, pressure and time, on the extent of the coal conversion and on product distribution. The data indicate that it is possible to solubilize part of the coal by using Athabasca bitumen and related liquids as solvents, and the extent of solubilization varies depending upon the type of solvent used. Control experiments were performed in order to determine the degree of coke (toluene insoluble) formation during the thermal treatment of the solvents. Coke formation was anticipated since oil sands bitumen and heavy oil are susceptible to heat. Composition of gases from the thermal treatment of solvents shows that the gas products mainly consist of hydrocarbons and hydrogen sulfide. Compositional differences of the solvent as a result of heat treatment also occur and there are variations in the distribution of products–coke (toluene insolubles), liquids (toluene solubles), and gases. 6 refs., 1 fig., 10 tabs.

35519 (CONF-890582–1) **Characterization and subsequent utilization of microbially solubilized coal: Preliminary studies.** Davison, B.H.; Nicklaus, D.M.; Woodward, C.A.; Lewis, S.N.; Faison, B.D. Oak Ridge National Lab., TN (USA). 1989. 38p. Sponsored by DOE/FE;EPRI. DOE Contract AC05-84OR21400. From Biological processing of coal and coal-derived substances; Palo Alto, CA, USA; 16-17 May 1989. Order Number DE89011577/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The solubilization of low-ranked coals by fungi, such as Paecilomyces and Candida, in defined submerged culture systems has been demonstrated. Current efforts focus on the characterization of the aqueous solubilized coal products and the development of technologies for their subsequent utilization. Solubilized coal products have been fractionated, and preliminary characterizations performed. Differences in product composition have been detected with respect to the organism used in culture duration. Prospects for the conversion of the aerobically-solubilized coal into less-oxidized products have been developed which can remain active and viable in the presence of the aqueous coal product or vanillin, a coal model compound. The results suggest that a methanogenic consortium was able to produce methane and carbon dioxide from the product of coal biosolubilization by Paecilomyces as a sole carbon source. Work continues on the development of cultures able to convert the aqueous coal product and its various fractions into methane or fuel alcohols. 17 refs., 8 figs.

35520 (CONF-8511136–7) **Microbial coal liquefaction.** Scott, C.D.; Strandberg, G.W. Oak Ridge National Lab., TN (USA). 1985. 23p. Sponsored by DOE Fossil Energy. DOE Contract AC05-84OR21400. From Direct liquefaction contractors conference; Pittsburgh, Pennsylvania, USA; 19-21 Nov 1985. Order Number DE89014193/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The production of apparent coal-derived, water-soluble products occurs when certain microorganisms are cultured in the presence of low-ranked coal. The potential utility of these organisms to convert coal to useful liquid products is being investigated. Particular emphasis is being placed on determining the operating parameters that affect liquefaction, on establishing the characteristics of the liquid products, and on studying potential process approaches that could be used for large-scale operation. Various fungi appear to be the most active organisms and several species have been found associated with lignite in the natural state. Lower-ranked coals seem to be better substrates, although biological action on one subbituminous coal was observed. Liquefaction rate appears to be related to the oxidation state of the coal, as well as other chemical characteristics. The liquid product is not well defined, but it includes a large number of soluble molecular constituents, some of which may have moderate to high molecular weights. Most work has been carried out with surface cultures; however, several different types of organisms can be induced to attach to the solid surface of coal when in suspension culture. The latter may represent the mode of operation for a large processing system. 9 refs., 7 figs., 5 tabs.

35521 (CONF-8806136–1) **The chemical origin of synergy in liquefaction and co-processing.** McMillen, D.F.; Malhotra, R.; Tse, D.S.; Nigenda, S.E. SRI International, Menlo Park, CA (USA). Chemical Physics Lab. 1988. 8p. Sponsored by DOE Fossil Energy. DOE Contract FG22-86PC90908. From American Chemical Society Division of Fuel Chemistry meeting; Toronto, Canada; 5-10 Jun 1988. Order Number DE89012984/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The question of possible synergistic effects for coal liquefaction has been raised recently in the context of coprocessing and also in that of straight donor-solvent liquefaction. Synergy is generally defined to occur when the effect of a combination of components exceeds the sum of the effects of the individual components. The existence of such synergism is more difficult to demonstrate in the coprocessing context, because liquefaction of coal alone, that is, in the absence of any other component (e.g., residual oil), is not viable in process terms, and therefore one of the boundary conditions is not available. Synergism can be much more readily assessed in the context of straight liquefaction, where there is always a liquefaction medium, which can be made up of a number of components. This paper specifically addresses liquefaction data, but the conclusions drawn are all equally applicable to coprocessing. 10 refs., 3 figs.

35522 (DOE/FE–0132) **Underground coal gasification program plan, FY 1989.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of the Deputy Assistant Secretary for Oil, Gas, Shale and Special Technologies. Jun 1989. 25p. Sponsored by DOE Fossil Energy. Order Number DE89013913/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A brief program plan for in-situ coal gasification is described. The following areas are discussed: Background and program goal; Technology description; Technology status and research needs; Program strategy; Program management; and International activities. 5 refs., 3 figs., 1 tab.

35523 (DOE/FE/60457–H4) **A fundamental research program in coal/heavy oil coprocessing and heavy oil processing: Final report.** Schulman, B.L. SFA Pacific, Inc., Mountain View, CA (USA). Jun 1989. 87p. Sponsored by DOE Fossil Energy. DOE Contract AC01-84FE60457. Order Number DE89013882/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The coprocessing of coal with petroleum residues provides an effective route for increasing the use of domestic resources—coal and natural gas—to produce liquid fuels. In addition, the initial step of converting petroleum residues alone by hydrocracking can significantly improve the yield of light fuels from crude oil. Several technologies have been developed and commercialized for hydrocracking residues and the liquefaction of coal. All of these technologies can be improved further, based on concepts that can come from a fundamental research program, and using the ideas developed in engineering studies. This work discusses a suggested 5-year research program to carry out fundamental work and explore ideas. The fundamental research program covers work to discover routes to improve yields and product quality when processing coal and petroleum residues together or separately. The program provides both an effective supplement and complementary bridge to the existing programs on coal processing and heavy oil characterization. The work includes the technical rationale and level of effort recommended to implement the studies in the key areas of: new catalysts, detailed feed and product characterization, new processing concepts, and product quality. 4 figs.

35524 (DOE/MC/23077–2696) **Engineering support services for the DOE/GRI coal gasification research program: Technical progress report for the period June 25–September 30, 1988.** Foster Wheeler USA Corp., Clinton, NJ (USA). 1988. 28p. Sponsored by DOE Fossil Energy. DOE Contract AC21-86MC23077. Order Number DE89012443/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of this contract is to provide technical support for the Department of Energy (DOE)/Gas Research Institute (GRI) Joint Operating Committee, which oversees and administers the DOE/GRI Joint Coal Gasification Research Program. The general scope of these support services consists of technical assistance in the following areas: evaluation of modular coal gasification combined cycle power systems; plant operating requirements; to report on results presented at a debriefing on hot gas cleanup; economic analysis; and an analysis of IGT's high pressure gasification data. 4 refs., 3 figs., 8 tabs.

35525 (DOE/PC/79808–T2) **Deactivation of hydrotreatment catalysts used for coal liquids: Semi-annual report, 12 May 1988–11 November 1988.** Dadyburjor, D.B. West Virginia Univ., Morgantown, WV (USA). Dept. of Chemical Engineering. 1988. 5p. Sponsored by DOE Fossil Energy. DOE Contract FC22-88PC79808. Order Number DE89014725/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Coal liquid hydrotreatment catalysts deactivate rapidly due to deposition of coke and metals inside the pores of the catalyst particles. The deactivation can be due to the gradual choking of the catalyst pores and/or due to the suppression of active sites on the catalyst. The objective of the proposed work is to determine which of these two mechanisms of deactivation is predominant, and this done by using the Constant Deactivation Arrhenius Plot (CDAP) technique. The Catalysts Co-Mo/Al_2O_3 and Ni-Mo/Al_2O_3 which have previously been deactivated to different extents in run number 242 at Wilsonville's coal liquefaction facility, are used in this study. The hydrodesulfurization of thiophene, which does not deactivate the catalyst, is used to characterize the relative activities of these catalysts. Arrhenius plots for these catalysts are being obtained. From the Arrhenius plots, the CDAP technique determines the intrinsic reaction rate constants and the effective diffusivities for each of these catalysts. 1 fig., 2 tabs.

35526 (DOE/PC/88801–T2) **Improved performance in coprocessing through fundamental and mechanistic studies in hydrogen transfer and catalysis: Quarterly report, December 27, 1988–March 27, 1989.** Curtis, C.W.; Guin, J.A.; Tarrer, A.R. Auburn Univ., AL (USA). Dept. of Chemical Engineering. 1989. 26p. Sponsored by DOE Fossil Energy. DOE Contract AC22-88PC88801. Order Number DE89013676/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

To gain fundamental understanding of the role and importance of hydrogen transfer reactions in thermal and catalytic coprocessing by examining possible donation from cycloalkane/aromatic systems and by understanding the chemistry and enhanced reactivity of hydrotreated residuum, by enriching petroleum solvent with potent new donors, nonaromatic hydroaromatics, thereby promoting hydrogen transfer reactions in coprocessing. This quarter, a complete literature search was performed on hydrogen donation in coprocessing and coal liquefaction. The objective of this search was to undercover the role of hydrogen transfer from different types of model molecules to one another as well as the role of hydrogen donation in coprocessing and coal liquefaction. 24 refs.

35527 (DOE/PC/88802–T1) **Exploratory coprocessing research: Quarterly report number 2, for the period December 1, 1988 to February 28, 1989.** Hirschon, A.S.; Tse, D.S.; Malhotra, R.; McMillen, D.F.; Ross, D.S. SRI International, Menlo Park, CA (USA). Apr 1989. 13p. Sponsored by DOE Fossil Energy. DOE Contract AC22-88PC88802. Order Number DE89014659/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objectives of this project are to: (1) study the scope of hydrothermal pretreatment of coal on subsequent conversion, (2) identify and study the chemical or physical causes of this effect, and (3) attempt to elucidate the chemistry responsible for any coal-resid synergisms. This project is divided into three tasks. Task 1 and 2 were addressed this quarter: (1) Scope of Aqueous Pretreatment. We conducted preliminary experiments this quarter in order to determine the correct operating conditions from which to base our subsequent experiments. In these experiments, we treated an Illinois number 6 coal with Maya ATB with 500 psi of hydrogen at 400°C. Chemistry of Pretreatment. Last quarter, we compared the pyrolysis of pretreated and non-pretreated Illinois number 6 coal by use of field ionization mass spectroscopy (FIMS), and found from a difference spectrum of the two samples that the pretreated coal produced more volatiles at lower temperatures than the non-pretreated coal. However, the pretreated coal also contains a smaller particle size distribution than the non-pretreated coal. This quarter we ran a similar experiment comparing the FIMS of the coal with two different particle size distributions. We also investigated the pyrolysis chemistry of phenolics, which we believe to be a potential source of regressive reactions.

35528 (DOE/PC/88920–T1) **Electrochemistry of thiobacillus ferrooxidans reactions with pyrite: Technical progress report, January 15–April 15, 1989.** Pesic, B. Idaho Univ., Moscow, ID (USA). Dept. of Metallurgical and Mining Engineering. 1989. 30p. Sponsored by DOE Fossil Energy. DOE Contract FG22-88PC88920. Order Number DE89013103/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of this project is to provide the fundamental information on the mechanisms of bacterial leaching of pyrite. The knowledge of how bacterial leaching of pyrite works is essential for design and development of a technology for coal cleaning with bacteria. The features of major electrochemical techniques will be examined to find out if any of them can provide diagnostic information on the mechanisms of related reactions. This project will have several major research directions. One of them is the electrochemistry of interactions of Thiobacillus ferrooxidans with mineral pyrite, the second is the electrochemistry of bacteria interactions with coal pyrite. The third major direction is the role of Thiobacillus ferrooxidans cell components (amino acids and vitamins) during oxidation of ferrous iron with oxygen. The research results from these three directions will be used to elucidate the reactions involved during interaction of Thiobacillus ferrooxidans with pyrite. Results of cyclic voltametry are presented. 17 figs.

35529 (DOE/PC/88922–T1) **Supercritical fluid thermodynamics for coal processing: Quarterly progress report, September 15, 1988–December 31, 1988.** Eckert, C.A. Illinois Univ., Urbana, IL (USA). Dept. of Chemical Engineering. 1988. 8p. Sponsored by DOE Fossil Energy. DOE Contract FG22-88PC88922. Order Number DE89014214/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Because of their unusual solvating and mass transfer properties, supercritical fluids show potential for a variety of coal processing applications. To establish a database of coal model compound equilibria, this quarter we have measured the solubility of 5,6-dimethyl-benzimidazole and anthraquinone in supercritical butane. In addition, we have used fluorescence spectroscopy to study the nature of the intermolecular interactions in the systems of pyrene and naphthalene in supercritical CO_2, C_2H_4, and CF_3H. The spectroscopy measurements are being used to guide the development of an equation of state that can be used to predict the solubility behavior so systems can be designed for the processing of coal with supercritical fluids. 4 figs.

35530 (DOE/PC/90523–T4) **Phase equilibrium data for development of correlations for coal fluids: Report for the period April 15, 1989–June 15, 1989.** Robinson, R.L. Jr. Oklahoma State Univ., Stillwater, OK (USA). School of Chemical Engineering. 15 Jun 1989. 17p. Sponsored by DOE Fossil Energy. DOE Contract FG22-86PC90523. Order Number DE89014505/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The effective design and operation of processes for conversion of coal to fluid fuels requires accurate knowledge of the phase behavior of the fluid mixtures encountered in the conversion processes. The overall objective of this work is to develop accurate predictive methods for representation of vapor-liquid equilibria in systems encountered in coal-conversion processes. During the present report period, data have been obtained on the solubility of methane in n-octacosane (n-C_{28}) at 348.1 K, 373.1 K, and 423.1 K, and in n-hexatriacontane (n-C_{36}) at 373.1 K and 423.1 K. These data are well described by the Soave and Peng-Robinson equations of state and the Krichevsky-Kasarnovsky correlation. The present data for methane and n-octacosane are in reasonable agreement with those reported by Stanley and co-workers. For methane + n-hexatriacontane at 373.1 K, larger disagreements are observed between the present data and those reported by Tsai and co-workers. 16 refs., 4 figs., 5 tabs.

35531 (DOE/PC/90908–T6) **Factors controlling hydrogenolysis in coal liquefaction: Quarterly report No. 6 for the period October 1–December 31, 1987.** McMillen, D.F.; Malhotra, R.; Tse, D.S.; Nigenda, S.E. SRI International, Menlo Park, CA (USA). Feb 1988. 10p. Sponsored by DOE Fossil Energy. DOE Contract FG22-86PC90908. Order Number DE89013505/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of this study is to determine in greater detail the factors affecting radical hydrogen-transfer and other H-transfer modes shown in a previous DOE-sponsored study to be important

in solvent-mediated hydrogenolyses of model compounds and inferred to be important in coal liquefaction. We are investigating the cleavage rates of suitable model compounds in a variety of solvent systems with and without added coals, thereby assessing the relative importance of hydrogenolysis via free H-atoms and via radical hydrogen transfer (RHT). We have been able to differentiate between hydrogenolysis via the two processes by examining the selectivity of cleavage of 1,2'-dinaphthylmethane. To further aid our understanding to the competition in cleavage of strong bonds by various modes of H-transfer, we are conducting some mechanistic modeling studies. With these studies we can deconvolute the effects of solvent thermochemistry, concentration, hydrogen pressure, and temperature on various mechanisms for solvent-mediated bond cleavages, and thereby gain a better fundamental understanding of the competing processes. Finally, we are also trying to understand the impact of mass transport limitations that are likely to be important in actual coal liquefaction because of the heterogeneous nature of coal. 7 refs., 2 tabs.

35532 (EPRI-ER–6366) **The selective oxidation desulfurization process: bench-scale studies: Final report.** Tewksbury, T.L.; Carlton, H.E.; Cho Kim, B.; Fan, L.-S.; Oxley, J.H. Electric Power Research Inst., Palo Alto, CA (USA); Battelle Columbus Div., OH (USA). c May 1989. 58p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Five high-sulfur caking coals were desulfurized, under bench-scale conditions, using a fluidized-bed selective oxidation process. Earlier work with this selective oxidation process (EPRI report AP-4873) had shown very promising sulfur removal results under batch operating conditions. For this current work, the bench-scale unit was modified is that it could simulate continuous operation under more realistic conditions: the collection and recycle of fines, addition of SO_2 to the fluidizing gas, and semi-continuous feed. Under batch conditions, the reductions in sulfur achieved were generally equivalent to at least the pyritic sulfur content of each coal. The simulated continuous-operation experiments indicated that continuous operation might give slightly reduced sulfur-removal efficiencies. Temperatures of 725-775°F and residence times of 2-4 hours are required for near optimum sulfur removal. Gas compositions of 8-26% air (92 to 74% steam) were used. For Pittsburgh No. 8 seam coal, 70% reduction in total sulfur was achieved. Kentucky No. 9 seam coal had a sulfur reduction of over 60% and the two Illinois No. 6 coals were desulfurized by over 50%. Heating value losses from the coals during processing ranged from 5 to 40 percent. 11 figs., 7 tabs.

35533 (ERP/ERL–88-20(TR)) **Bibliography of CANMET publications on coprocessing.** Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Mar 1988. 48p. Available from CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1.

The term coprocessing refers to the processing of mixtures of coal and oil with the objective of liquefying the coal and upgrading the oil simultaneously. This bibliography provides a source of all publications produced by CANMET to date on coprocessing technology.

35534 (ETDE-mf–9788054) **Behaviour of secondary and trace elements during coal gasification in an iron bath.** Oehler, W. Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen. 13 Mar 1987. 98p. (In German). Order Number DE89788054/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Within the framework of this study, the distribution of some elements, particularly trace elements contained in coals, was examined, with respect to coal gasification in liquid iron baths. A selection of bibliographical data on the chemical analysis of accompanying and trace elements in coals and thermodynamic calculations of the distribution of the elements and their combination forms in gaseous phases, melts, and slags are compared with the results of practical gasification tests (distribution of the elements V, Mn, Cr, Cu, Zn and Si), carbon content being consitent, as well as with the bottom-blowing and blow-through methods of coal gasification in iron baths.

35535 (EUR–11729-DE) **Determining the density distribution in a 7 metre coke oven.** Eisenhut, W.; Huhn, F.; Strelow, F. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 23p. (In German).

The report is in two parts. This part describes a process which has been developed for determining the density distribution in a 7-metre coke oven. The measurements are taken with a modified radiometric density-moisture probe which uses the backscatter method as the measuring principle. A Cs 137 gamma emitter (10 mCi) and an Am 24 1/Be neutron emitter (100 mCi) act as radiation sources. The exact positioning of the probe in the oven charge is undertaken through special filling-hole lids, constructed to a high degree of precision using laser measurement, which are bolted on to the filling-hole frames. In order to comply with radiation protection instructions, the emitter capsules are manufactured from heat-resistant steel to allow for those cases in which the probe must remain in the oven until the end of the carbonisation period. This prevents the release of radioactive material. As a further means of protection, detector devices are arranged above the coke belts in the coke ramp area; these devices serve to shut-down the belt drives should high levels of radiation activity be detected. The first measurements indicated a large variation in the density of the charge in respect of its height. In addition, the density of the charge in the area beneath the filling holes was considerably greater than the average bulk density for the oven as a whole. This is partly dependent on the concentration of water in the centre of the charge. The main findings of the measurement programme will be published at a later date. The second part of this report contains two appendices and has been abstracted separately.

35536 (ORNL/FTR–3282) **[2nd international symposium on high-temperature corrosion of advanced materials and coatings, Les Embiez, France, and visit to Manchester, England, May 19–27, 1989]: Foreign trip report.** Wright, I.G. Oak Ridge National Lab., TN (USA). 12 Jun 1989. 11p. Sponsored by DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE89014746/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The primary purpose of this trip was to participate in the 2nd International Symposium on High-Temperature Corrosion of Advanced Materials and Coatings in France. Results from work were presented in a paper entitled "Effects of Minor Alloying Additions on the Development of Protective Oxides Scales at 700°C," while other activities were to chair the conference session on Databanks and Expert Systems, and to participate in review of manuscripts and arrangement for the publication of the conference proceedings. Discussions at the conference that were useful to our ongoing ORNL research program concerned the effects of rare-earth additions on the development of protective oxide scales, and the role of stress generated either from the growth of oxide scales or from differential thermal expansion between oxide scales and alloy substrates on the protective nature of scales, and on techniques to measure some of these effects in situ. A visit was also made to the UMIST in Manchester, England, to discuss the results of work of a similar nature to that in progress at Battelle. In general, UMIST results are quite similar to those found at Battelle and provide some insights into the detailed modes of breakdown of chromia and alumina scales. Simple experimental techniques that were developed to try to pinpoint key features of scale breakdown proved to be quite insightful, and will be applied to some of the specimens generated in the Battelle studies.

35537 (ORNL/FTR–3283) **[2nd International symposium on high-temperature corrosion of advanced materials and coatings, Les Embiez, France, May 22–26, 1989]: Foreign trip report.** Srinivasan, V. Oak Ridge National Lab., TN (USA). 12 Jun 1989. 23p. Sponsored by DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE89014747/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler participated in the 2nd International Symposium on High-Temperature Corrosion of Advanced Materials and Coatings and presented an invited paper. He chaired a session on High-Temperature Corrosion. The symposium covered 11 themes over 4-1/2 days. There were two sessions each day, one in the morning and one in the evening, with afternoons devoted to poster sessions. This provided opportunities for the participants to have private discussions on topics of mutual interest. About 180 participants from

the European Economic Community countries, Brazil, Canada, Japan, Republic of China, USA, and USSR attended the symposium. The presentations included papers on high-temperature corrosion and oxidation (44), coatings (35), ion-beam and laser-modified surfaces (20), hot corrosion (14), scale adherence and stresses in the scales (7) diffusion (3), erosion/corrosion (3), synergism between corrosion and mechanical properties (10), intermetallics (4), and industrial experience (5). Most of the presentations involved corrosion/oxidation of Fe-, Ni- and Co-base alloys and coatings with and without reactive element additions that are of interest to fossil energy programs of ORNL and DOE. The traveler had private discussions with other participants. 1 tab.

35538 (ORNL/Sub–83-43346/02) **Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1.** Kim, G.M.; Meier, G.H. Oak Ridge National Lab., TN (USA); Pittsburgh Univ., PA (USA). Dept. of Materials Science and Engineering. 31 Jan 1989. 81p. Sponsored by DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE89014789/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The breakdown mechanisms of preformed oxide scales, Cr_2O_3, Al_2O_3 and SiO_2, have been studied at low oxygen and high sulfur potentials in the temperature range 550 to 950°C. For Cr_2O_3 on Ni-30Cr, sulfur penetration occurs through thin areas in the Cr_2O_3 scale. The first sulfides to form on Fe-25Cr and Co-30Cr were observed at the scale/gas interface as the result of Fe or Co transport through the Cr_2O_3 scale. Alumina scales on Fe-18Cr-6Al-1Hf were broken down by crack formation. Addition of Hf to the alloy improved scale adherence and extended the time to breakdown. Additions of Ti to Fe-18Cr-6Al provided improved scale adherence without introducing continuous paths through the oxide scales. These scales were even more resistant than those on the Hf-containing alloys when exposed in high sulfur potential atmospheres. These results also extended to long term cyclic sulfidation/oxidation experiments and simulated syngas exposures. Pure alumina scales were never formed on Ni-18Cr-6Al and Co-18Cr-6Al alloys and the NiCrAl alloy underwent catastrophic corrosion in most sulfidation/oxidation exposures. For SiO_2 on Ni-20Si, although porosity can form at the scale/gas interface due to the high vapor pressures of SiS and SiO, the formation of a thin layer of vitreous silica and good scale adherence provide better resistance to sulfur penetration than do Cr_2O_3 and Al_2O_3. The SiO_2 scales formed on Fe-20Si and Co-20Si were not as protective as those formed on Ni-20Si. 33 refs., 42 figs.

35539 (ORNL/TM–11176) **Sulfidation/oxidation properties of iron-based alloys containing niobium and aluminum.** DeVan, J.H.; Hsu, H.S.; Howell, M. Oak Ridge National Lab., TN (USA). May 1989. 34p. Sponsored by DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE89013766/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Compatibility with mixed gases containing S, O, and Cl is a critical requirement for high-temperature alloys used in coal conversion and combustion applications. Comparative corrosion tests of Fe-25Cr-20Ni, Fe-18Cr-6Al, and Fe-9Cr-9Nb-6Al (wt %) at 700 to 800°C in a simulated coal gasification environment led to the development of Fe-Nb-Al alloys and testing of both Fe-Nb-Al and Fe_3Al alloys. The niobium and aluminum content in the latter alloys ranged from 8 to 18 and 6 to 16 wt %, respectively. The niobium addition was intended as a selective refractory sulfide former. Testing was carried out at 700 to 800°C in H_2S-H_2-H_2O gas mixtures with relatively low oxygen activities ($\leq 10^{-22}$ atm) and high sulfur activities ($\geq 10^{-6}$ atm). Metallographic and chemical analyses of the corrosion product scales and the underlying alloy were performed to determine the role of the respective metallic elements on sulfidation/oxidation processes. 8 refs., 14 figs., 3 tabs.

35540 (PB–89-160915/XAB) **Cool Water Coal Gasification Program: Monitoring Review Committee meeting report, Washington, D.C., July 12, 1988.** Cool Water Coal Gasification Program, Daggett, CA (USA). 1988. 126p. Available from NTIS, PC A07/MF A01.

See also PB–89-160907.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Cool Water Coal Gasification Program is one of the four projects awarded financial assistance. The program agreed to comply with existing environmental monitoring in the areas of water, air, solid waste, worker health and safety, and socioeconomic impacts during the period 1984-1989. As the first commercial-scale integrated gasification combined-cycle plant for generating energy from coal, the plant is designed to process a variety of coals with no liquid discharge, produce non-hazardous solid wastes, and produce very few air emissions. Monitoring data are to provide an information base for evaluating plant operations and for establishing information on environmental uncertainties associated with replication of synthetic-fuels facilities. A Monitoring Review Committee (MRC) comprised of participants from DOE, EPA, and the California Energy Commission, meets with the Program annually to discuss monitoring activities and review environmental and health monitoring information to determine any significant trends or patterns on pollutants releases. Results of the annual MRC meeting held July 12, 1988 in Washington, DC are presented.

35541 (PB–89-165104/XAB) **Quick-response evaluation of energy-related occupational safety and health programs. Task Order 1: mortality study of 50 workers exposed to coal-liquefaction processes at a Union Carbide Plant, Institute, West Virginia.** Palmer, A. SRI International, Menlo Park, CA (USA). Center for Occupational and Environmental Safety and Health. Nov 1977. 11p. Available from NTIS, PC A03/MF A01.

A study was undertaken of 50 Union Carbide employees who had been exposed to high-boiling oils containing polycyclic hydrocarbons, coal tar, and pitch. The exposures occurred as a result of a coal-hydrogenation process initiated at the West Virginia facility in May of 1952. Workers were given annual physical examinations and, beginning in 1955, quarterly skin inspections. A review of the findings does not support the initial hypothesis that those workers exposed to heavy streams of toxic materials who developed cancerous skin lesions were at risk for developing systemic carcinoma. Indeed, there was a marked lack of cancer-related deaths or morbidity in the study group after a latency period of 18 to 20 years. One case of lung cancer was reported in a subject at 60 years of age, after a lifetime of smoking. One case of prostatic cancer was diagnosed at 77 years of age. A review of the five deaths listed indicated all were cardiac related including coronary disease, arteriosclerotic disease, cor pulmonale, and myocardial disease.

35542 (PB–89-166730/XAB) **Feasibility of industrial coal conversion at Cornell University. Final report.** Bland, R.R. Cornell Univ., Ithaca, NY (USA). Dec 1984. 287p. Available from NTIS, PC A13/MF A01.

Portions of this document are not fully legible.

The New York State Energy Research and Development Authority has completed a project identifying the opportunities for replacing oil and gas with coal at Cornell University in Ithaca. This report investigates using coal to produce steam for heat and the on-site cogeneration of electricity. At Cornell, electricity is purchased primarily from the local utility, chilled water is produced by electric-driven chillers and most of the heat comes from steam produced by coal, oil, or gas boilers in a central-heating plant. A study was made to integrate the utility systems and demonstrate the feasibility of further industrial coal conversion at Cornell. Although there are two existing coal boilers used on campus, there could be significant economic benefits from displacing gas and oil. Coal conversion technologies studied include: installation of a new boiler for the existing central-heating plant; reconversion back to coal of an oil-fired boiler; low-Btu gasification; and evaluating the possible construction of a new central heating plant.

35543 (PB–89-167209/XAB) **Assessment of the techno-economic potential of Fischer-Tropsch slurry reactors.** Van Vuuren, D.S. Council for Scientific and Industrial Research, Pretoria (South Africa). Jul 1987. 33p. (CSIR-CENG–655). Available from NTIS, PC EE05/MF E03.

Summary in Afrikaans. North American Continent sales only.

Fischer-Tropsch (F-T) slurry reactors have considerable techno-economic potential for the South African synthetic-fuels industry, particularly in combination with gasifiers producing a synthesis gas with a low hydrogen content. For this combination, a cost benefit of

19% compared with existing commercial F-T processes is estimated. Slurry reactors make it possible to use low-hydrogen synthesis gas to provide flexibility in the product spectrum and to achieve high conversion per pass with stoichiometric consumption of the feed-gas components. Consequently, there is little need for gas recirculation and the generation of a fuel-gas fraction can be avoided. Recommendations cover: conceptual design studies of gasifier-slurry reaction combinations; development of F-T slurry reactor technology on a pilot scale; generation of fluid dynamic design information on F-T slurry reactors; development of F-T catalysts for the slurry environment, and consideration of the requirements for upgrading the reactor products.

35544 (PB–89-178735/XAB) **Coal-test program in a pressurized, fluidized-bed ash-agglomerating process development unit. Volume 2. Data analysis. Final report, November 15, 1984-August 31, 1987.** Goyal, A.; Rehmat, A. Institute of Gas Technology, Chicago, IL (USA). Mar 1989. 264p. Available from NTIS, PC A12/MF A01.

See also PB–88-104658.

The objective of the project is to extend the ash-agglomerating fluidized-bed gasification data base of important American coals to pressures of 500 psig. A series of gasification tests in IGT's 8-inch process development unit (PDU) with lignite and subbituminous coal produced steady-state data at 100, 200, and 300 psig. After GRI reviewed an analysis of this data, the PDU system was upgraded to 500-psig operating capability. A matrix of gasification tests were then completed with lignite and subbituminous coal at 200, 300, and 450 psig, and material and energy balances were prepared for various set points. A statistical technique was applied to reconcile the steady-state data estimating maximum-likelihood true measurement values while closing all element and energy balances exactly. Science Ventures, Inc. of California developed such a data-reconciliation computer software package known as BALAID. It takes advantage of all available measurement information, as well as information embodied in the conservation laws and in the estimated quality of the measurements. This program has been applied to the steady-state data resulting in improved balances.

35545 Evaluation of an on-line gas chromatographic system. Gibbon, G.A. (U.S. Dept. of Energy, Pittsburgh, PA (US)); Hackett, J. v.v of 1988 Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy (abstracts). Pittsburgh Conference, Pittsburgh, PA (1988). (CONF-880204–: 39. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, New Orleans, LA, USA, 22-26 Feb 1988).

Technical Paper NO. 209.

At the Pittsburgh Energy Technology Center (PETC), a concerted effort is being made to systematically transpose laboratory analytical methodology, developed during Fischer-Tropsch (FT) catalyst studies, to on-line applications. This report describes the chromatographic hardware developed for the combined on-line analysis of both the gas and the light-oil (volatile at 200^{0}C) phase produced during FT catalyst evaluation studies. The product stream contains H_2, CO, CO_2, H_2O, hydrocarbons (paraffins and olefins) and alcohols. Laboratory analysis of the condensed light-oil phase, from recent catalyst studies, have confirmed the presence of hydrocarbons up to C_{20} and primary alcohols up to C_{15}. Therefore, the on-line analytical system must be able to provide quantitative data on the above species and also to detect them at their vapor phase concentrations.

35546 Coal/oil coprocessing mechanism studies. Cugini, A.V. (USDOE Pittsburgh Energy Technology Center, PA); Lett, R.G.; Wender, I. *Energy and Fuels (USA),* 3(2): 120-126 (Mar-Apr 1989). (CONF-8806312–: Symposium on coal-derived fuels - coprocessing, Toronto, Canada, 5-10 Jun 1988).

Initial coprocessing studies performed to provide a basis for studying mechanisms associated with the coprocessing of coal and residual oil are described. Areas investigated included the response of coal and petroleum resid combinations to processing under thermal hydrotreatment conditions, the means of increasing the conversion of coal, and the nature of resid demetalation effects. It was found that Maya ATB was superior to Boscan ATB or North Slope VTB for the conversion of Illinois No. 6 coal to liquid or soluble products. The extensive demetalation of the liquid product observed was a function of the amount of coal added. Results obtained by using different coal and resid combinations under thermal conditions and in the presence of various additives suggest that an adsorptive mechanism is operative. The primary interactions leading to demetalation appear to be between the metal complexes of the resid and the insoluble carbonaceous coal-derived material. Demetalation of the liquid product was not dependent on conversion of the organically complexed metal in the resids to inorganic form. 18 refs., 8 figs., 10 tabs.

0105 By-products

Refer also to citation(s) 35681, 37647

0106 Properties

Refer also to citation(s) 35512, 35513, 35527, 35529, 35534, 35588, 35592

35547 (ARC–1989, pp. 6) **Solubilization of coal by reductive and non-reductive alkylation in liquid ammonia.** Ignasiak, B. (Alberta Research Council, Edmonton); Gawlak, M.; Carson, D.; Cyr, N. Alberta Research Council, Edmonton, AB (Canada). [1989]. (CE–02438). In *Alberta Research Council [research reports].* Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

Though a large number of degradation reactions have been adopted for the study of coal substance, considerably less has been done to convert coal into soluble products with little, if any, covalent bond cleavage or molecular rearrangement. This communication describes two of the coal solubilization methods which meet this requirement and have been developed recently in the Alberta Research Council laboratories. The author discusses first reductive alkylation in liquid ammonia, while the results indicate that, for the high rank coals, reductive alkylation in tetrahydrofuran is comparable with what it is in liquid ammonia, the reliability of tetrahydrofuran alkylation for lower rank coals appears to be quite questionable. Non-reductive alkylation in liquid ammoniais also discussed. It appears that the reductive ethylation method, though it undoubtedly leads to some covalent bond cleavage, can be applied for the determination of the molecular weight distribution of a low rank bituminous coal. The non-reductive ethylation studies emphasized differences between Cretaceous and Carboniferous coals. The solubilities in chloroform of ethylated Carboniferous coals appear to be much higher as compared with their younger counterparts, though the number of ethyl groups introduced is of the same order. Furthermore, nuclear magnetic resonance seems to indicate that, in Carboniferous coals, the structural units mainly responsible for the alkylation are those of 9,10 dihydrophenanthrene and fluorene types. 7 refs., 2 figs., 2 tabs.

35548 (CRL–87-123(OP,TR)) **Methane desorption in coal handling.** Das, B. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Nov 1987. 34p. Available from CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1.

Methane desorption can cause problems in all areas of coal handling - mining, storage, transportation, preparation and utilization. In order to minimize the hazard it is necessary to have a clear understanding of the process of methane desorption. This paper discusses methane desorption characteristics with a view to reducing potential hazards. 7 refs., 16 figs.

35549 (CRL–88-23(OP,J)) **Coal dustiness: characterization and control.** Mikula, R.J.; Parsons, I.S. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Mar 1988. 27p. Available from CANMET, 555 Booth St, Ottawa, Canada, K1A OG1.

This paper examines the problem of coal dustiness, and methods for its control. ASTM Test D547 is commonly used for evaluation of coal dustiness, however it is often ineffective in determining how well dust control agents will work in field situations. CANMET has developed, and provides information on, a number of alternative tests for coal dustiness. Results of a number of dust control tests are also included. 3 refs., 12 figs.

35550 (CRL–88-55(TR)) **Measurements of solids concentrations in coal slurries using microwaves.** Mansour, N.A. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Aug 1988. 12p. Available from CANMET, 555 Booth St, Ottawa, Canada, K1A OG1.

This paper examines the potential use of microwaves in measuring solids concentration in a coal-water slurry. Dielectric data on coal and water are provided. The microwave absorption technique appears to provide better results than those obtained by dielectric measurements. 6 refs., 4 figs.

35551 (DOE/PC/79905–T7) **Fundamental research on surface science of coal in support of physical beneficiation of coal: Quarterly technical progress report, January 1–March 31, 1989.** Good, R.J.; Keller, D.V. Jr. State Univ. of New York, Buffalo, NY (USA). Dept. of Chemical Engineering. 1989. 26p. Sponsored by DOE Fossil Energy. DOE Contract AC22-87PC79905. Order Number DE89013104/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Research on coal surfaces continued. Our contact angle study of the decane-water-coal system has been extended using various ranks of coal. The study of the effect of surface oxidation on contact angles has also been extended to Upper Freeport, Illinois No. 6 and Kentucky No. 9 coals. Measurements of contact angles of liquid-air interfaces, on polished surfaces of coal of two different ranks, have been made using the captive drop technique. The data have been analyses using the acid/base theory. Some preliminary contact angle measurements have been made on rock pyrite, using the microscopic technique. The measurements were carried out for decane-water interfaces. A study of laboratory-scale agglomeration has been undertaken, using an Osterizer blender. The coals used were Illinois No. 6 and Kentucky No. 9. The effect of CO_2 on the agglomeration process has been looked into. Finally, the adsorption alcohols (cyclohexanol and n-octanol) from both aqueous and non-aqueous solutions, onto coal, has been measured. Two ranks of coal were used: Upper Freeport (mvb) and Illinois No. 6 (hvcb). 9 refs., 6 figs., 17 tabs.

35552 (DOE/PC/79907–T5) **Spectroscopic study of coal structure and reactivity: Quarterly report, January 1, 1989 to March 31, 1989.** Griffiths, P.R. California Univ., Riverside, CA (USA). Dept. of Chemistry. 10 May 1989. 10p. Sponsored by DOE Fossil Energy. DOE Contract FG22-87PC79907. Order Number DE89013684/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Several areas on the study of coal and coal extracts have been investigated. These are: the use of thin layer chromatography interfaced to diffuse reflectance infrared Fourier transform spectrometry (DRIFT); combined deconvolution and curve-fitting; diffuse reflectance spectrometry; air oxidation; and photoacoustic spectrometry. 3 figs. (CBS)

35553 (DOE/PC/79914–T5) **Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, January 15, 1989–April 15, 1989.** Peppas, N.A. Purdue Univ., Lafayette, IN (USA). School of Chemical Engineering. 1989. 29p. Sponsored by DOE Fossil Energy. DOE Contract FG22-87PC79914. Order Number DE89013100/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Experimental studies are reported of diffusion in thin sections of various coal samples. Data are presented of the transport of methylene chloride, chloroform, pyridine, methyl ethyl ketone, toluene, benzene, methanol, acetone and cyclohexane in coals PSOC 418, 853 and 384. The results are analyzed in terms of solubility parameters and the polar contribution to the solubility. 2 refs., 18 figs., 2 tabs.

35554 (DOE/PC/88925–T1) **Correlation of stability/rheology relationship with coal properties and chemical additives: Quarterly progress report, September 15, 1988–December 15, 1988.** Ohene, F. Grambling State Univ., LA (USA). Dept. of Chemistry. 1988. 11p. Sponsored by DOE Fossil Energy. DOE Contract FG22-88PC88925. Order Number DE89014504/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In an effort to establish a criteria for designing and preparing coal-water slurry (CWS) for utilization, the relationships between coal properties and slurry quality must be determined. These relationships will enable the prediction of potential CWS quality for the particular coal candidate from some characteristic(s) of the coal. The coal content at a given viscosity varies for different coal. Thus, to develop a viable coal selection strategy using chemical surfactants as additives, the adsorption of these surfactants by the coal particle surface must be established. This work therefore, intends to screen a number of chemical surfactants and dispersants which can be used in the preparation of coal water slurry. The information derived from this screening together with the coal properties will be used to help develop a prescription to predict the stability of coal slurries. 7 refs., 1 fig., 3 tabs.

35555 (DOE/PC/90502–11) **Catalyst accessibility in high volatile bituminous coal: Quarterly report.** Kispert, L.D. Alabama Univ., University, AL (USA). Dept. of Chemistry. Jul 1989. 7p. Sponsored by DOE Fossil Energy. DOE Contract FG22-86PC90502. Order Number DE89014117/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

As reported previously, an EPR technique has been developed in this lab to determine the pore size and number distribution in high volatile bituminous coal using nitroxide spin probes I-IX of different sizes, shapes and reactivity. This quarter, the Bruker EPR/ENDOR spectrometer (ESP 300-10/7 with an ESP 350-U ENDOR/TRIPLE accessory) was delivered and successfully installed. We are pleased that we have been successful in obtaining weak but interpretable ENDOR spectra from the EPR spin probe doped coal samples. 5 refs., 3 figs.

35556 (DOE/PC/90504–T10) **Configurational diffusion of coal macromolecules: Quarterly progress report, March 16–June 15, 1989.** Guin, J.A.; Curtis, C.W.; Tarrer, A.R. Auburn Univ., AL (USA). Dept. of Chemical Engineering. 1989. 15p. Sponsored by DOE Fossil Energy. DOE Contract FG22-86PC90504. Order Number DE89013782/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During this quarter, work was centered on the study of etching characteristics of polycarbonate films having fission tracks. Etching curves for the polycarbonate films aged at room conditions for more than 6 months were obtained. The effects of several experimental parameters on the etching rate of the polycarbonate films were investigated also. It was observed that concentration of caustic solution and etching temperature affected significantly the etching rate of the polycarbonate films. The etching rates of damaged regions by fission fragments were faster than the etching rates of undamaged regions. 7 refs., 4 figs.

35557 (DOE/PC/90507–T11) **Surface properties of coal and their role in coal beneficiation: Technical progress report, March 15, 1989–June 14, 1989.** Fuerstenau, D.W. California Univ., Berkeley, CA (USA). Coll. of Engineering. Jul 1989. 11p. Sponsored by DOE Fossil Energy. DOE Contract FG22-86PC90507. Order Number DE89014166/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The main goal of this research is to delineate the wetting behavior of coal and its subsequent effects on fine coal processing. As both bulk and surface properties of coal are interrelated and have a controlling role in the performance of these processes, a detailed study has been undertaken to correlate their influence on both wetting behavior and the response of coal to flotation. During this current reporting period, the major effort was directed towards investigation of the effect of pH and oxidation on the induction time of coal.

35558 (DOE/PC/90508–T8) **Continuous thermodynamics and group contribution methods for coal liquids: Final report, October 1, 1986–October 1, 1989.** Allen, D.T.; Behmanesh, N.; Vajdi, L.E. California Univ., Los Angeles, CA (USA). Dept. of Chemical Engineering. 1989. 168p. Sponsored by DOE Fossil Energy. DOE Contract FG22-86PC90508. Order Number DE89011390/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

Structural profiles of narrow-boiling range fractions from three coal liquefaction processes were determined by identifying the major functional groups in the distillates and estimating their concentrations. The structural profiles were based on an extensive set of analytical data including results from elemental analysis, proton nuclear magnetic resonance, mass spectrometry, infrared

spectroscopy and liquid chromatography. The functional group distributions were then interfaced with group contribution methods for property estimation. Heat capacities, critical constants, activity coefficients, hydrogen solubilities and vapor pressures were estimated for the narrow boiling fractions. The predictions have been compared to the predictions of more conventional property estimation methods and to experimental data. In addition, sensitivity analyses have been performed to determine which structural features in the coal derived liquids are most important in estimating the values of thermodynamic properties. 43 refs., 16 figs., 59 tabs.

35559 (DOE/PC/90521–T10) **Role of porosity in supercritical fluid extraction of coal: Technical progress report.** Bale, H.D. North Dakota Univ., Grand Forks, ND (USA). Dept. of Physics. 15 Jun 1989. 11p. Sponsored by DOE Fossil Energy. DOE Contract FG22-86PC90521. Order Number DE89014727/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The major emphasis of our recent work has been directed towards establishing the role that the micropore structure plays in fluid extraction of coal. Specifically, we have contended that the micropore structure formed in the temperature range of 380°C acts as a "root system" that makes possible the intimate contact between the fluid and coal molecules required for extraction. In this report we will study the micropore swelling characteristics more closely making use of scattering theory and also by using large angle x-ray diffraction to examine possible changes in the graphite structure of the coal due to micropore formation or fluid imbition. In addition, we will discuss our small angle scattering measurements made on Pittsburgh No. 8 bituminous coal during fluid extraction. 5 figs.

35560 (DOE/PETC/TR–89/6) **Structural definition of synthetic fuels, Wilsonville I.** Perry, M.B.; Schmidt, C.E.; White, C.M. USDOE Pittsburgh Energy Technology Center, PA (USA). May 1989. 74p. Sponsored by DOE Fossil Energy. Order Number DE89013627/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report summarizes the results of an in-depth characterization of products formed from Wilsonville Run 245. Specifically, the Thermal Hydrocracker, Catalytic Hydrotreater, and Thermal Hydrocracker vacuum still bottom products were further distilled into well-defined, narrow-boiling-range distillates. The physical, chemical, and thermodynamic properties of these distillates were measured, including specific gravity, refractive index, boiling point, elemental composition, viscosity, number-average molecular weight, and others. These results were then empirically correlated with one another. 25 refs., 15 figs., 30 tabs.

0108 Waste Management

Refer also to citation(s) 35565, 35585, 35594, 35958, 35959, 35962, 35963

35561 (CRL–87-134(TR)) **Fly ash/cement packing for Lingan Mine: final appraisal and trial proposal.** Cain, P.; Harvey, A.; Aston, T.R.C. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Nov 1987. 42p. Available from CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1.

This report discusses recent research in Nova Scotia on the development of a packing system using fly ash and ordinary Portland cement. A review of the Parsonage Flashpack system (UK) is given and an outline of requirements for a successful packing system at Lingan Mine, N.S. is presented. Details of a proposed underground trial of the packing system, including associated costs and benefits, is also included. 4 refs., 2 tabs., 4 figs.

35562 (PB–89-169262/XAB) **Feasibility study of utilization of coal-mine refuse; Estill County, Kentucky.** Kentucky Univ., Lexington, KY (USA). Research Foundation. Aug 1976. 309p. Available from NTIS, PC A14/MF A01.

Portions of this document are not fully legible.

This report is a preliminary study of the physical and chemical characteristics of coal-mine refuse from eastern Kentucky bituminous coal stored in Estill County at the South-East Coal Company cleaning facility to determine the economic feasibility of commercial use of the refuse. The report covers refuse sampling, extensive analysis and testing, production of materials for use in the construction industry, market analysis for the materials that it would be feasible to produce, a preliminary capitalization plan, and flowsheet for light-weight aggregate production, and other factors.

35563 (PB–89-172183/XAB) **Cost impact of potential RCRA (Resource Conservation Recovery Act) changes on New York State Utility coal-waste disposal. Final report.** Kurgan, G.J. Baker (Michael), Jr., of New York, Inc., NY (USA). Nov 1983. 127p. Available from NTIS, PC A07/MF A01.

Presently, waste from coal burned by utility companies is exempted from regulations controlling hazardous wastes. The U.S. Department of Environmental Protection (EPA) is reconsidering these exemptions, and once the EPA study is completed, it is possible this exemption will be lifted and new, more-stringent hazardous waste disposal conditions will be put into effect. This report analyzes the cost effects of these contemplated new regulations. Two separate scenarios are considered. In the first scenario, extrapolated results for 1991 (in '83 dollars) show an increase from present estimated cost State wide of $87.7 million to $92.3 million, an increase by a factor of 1.1. Under scenario two, this $87.7 million would increase to $196 million in the same time, an increase by a factor of 2.2. Detailed tables are included for both scenarios and can be used to tailor the case studies to specific disposal sites.

35564 (TVA/RDG/EQS–89-2) **Development of dredged ash disposal area: Johnsonville Fossil Plant: Final environmental assessment.** Tennessee Valley Authority, Knoxville, TN (USA). Environmental Quality Staff. 1989. 65p. Order Number DE89014511/JAW. Available from NTIS, PC A04/MF A01 - OSTI.

Johnsonville Fossil Plant is located on the east shore of Kentucky Lake and is approximately 12 miles west of Waverly, Tennessee. The plant has 10 coal-fired units with a total generating capacity of 1485 megawatts. The first unit began operation in late 1951 and the tenth unit in 1959. The present coal ash disposal method at Johnsonville is sluicing fly ash and bottom ash to the active ash pond, which is 91 acres in size. This pond requires periodic dredging to maintain compliance with the NPDES permit free water volume requirement. The ash dredged from this pond has been hydraulically conveyed to settling ponds constructed in the rail loop area on the TVA reservation. With the current ash production at Johnsonville averaging 255,000 tons per year, the rail loop will reach maximum storage capacity in 1990. In order to continue future electrical generation at Johnsonville, the development of a new ash disposal area is needed by 1990. This assessment is to evaluate the environmental consequences associated with the development of a new area for dredged ash disposal and an associated small borrow area. 8 refs.

0109 Environmental Aspects

Refer also to citation(s) 35541, 35549, 35564, 37217

35565 (DOE/EIS–0146D) **Clean Coal Technology Demonstration Program: Draft Programmatic Environmental Impact Statement.** USDOE, Washington, DC (USA). Jun 1989. 293p. Sponsored by DOE Fossil Energy. Order Number DE89013883/JAW. Available from NTIS, PC A13/MF A01 - OSTI; GPO Dep.

The proposed action evaluated in this draft PEIS is to continue the Clean Coal Technology Demonstration Program (CCTDP) involving the selection, for cost-shared federal funding, of one or more clean coal projects proposed by the private sector. The draft PEIS addresses the potential environmental consequences of the widespread commercialization of the successfully demonstrated clean coal technologies by the private sector in the year 2010. This analysis of programmatic issues, along with additional environmental information and analysis containing business confidential or proprietary information, will be used by DOE in making decision on specific proposals during the selection process. The draft PEIS evaluates a no-action alternative, which assumes the CCTDP is not continued and conventional coal-fired technologies with conventional flue gas desulfurization controls would continue to be used, and a proposed action alternative which assumes that CCTDP projects are selected for funding and that successfully demonstrated technologies undergo widespread commercialization by the year 2010. The analysis of environmental consequences focuses on

changes to sulfur dioxide (SO_2), oxides of nitrogen (NO_x), carbon dioxide (CO_2), and solid wastes. An upper bound of change to each of these four parameters was estimated for each of 22 clean coal technologies, separately, assuming full penetration of potential markets. Potential effects of the CCTDP on land use, water resources, ecological systems, endangered and threatened species, socioeconomic resources, and human health and safety are also evaluates in the draft PEIS. 139 refs., 41 figs., 56 tabs.

35566 (NEI-NO–82, pp. 139-149) **Acidification of infiltration waters as a result of the seepage through carboniferous host-rocks.** Witczak, S.; Szczepanska, J. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

The formation of acid infiltration waters is presented. This process results from the oxidation of iron sulphides/pyrite mainly/which are the common accessory minerals in the Carboniferous host-rocks forming coal mine spoils in the area of Upper Silesian Coal Basin. The problem concerns large areas where the coal mine spoils are or will be deposited. It is predicted that between 1984 and 2000 about 900 mln cubic meters of spoils will be additionally deposited as a results of the extensive development of coal mining. Significant amounts of coal-mine spoils are deposited outside the controlled tips and are indusrtially utilized for road and hydrotechnical constructions. It causes the formation of numerous local sources of the pllution of the natural water environment. Transformation of waters infiltrating into coal mine spoils has been studied both ⁱn situand during lysimetric modelling investigated. Frech Carboniferous coal mine spoils and the spoils that bad been weathered for about 10 years were used in the lysimetric observations. The trans- formation of infiltrating waters indicates that even the 1,5 meter thick layer of coal mine spoils can produce acid waters for the decades of year. Analysis of natural pore solutions squeezed by using the pressure method supports the lysimetric observations. 4 figures, 1 table, 4 references.

0120 Mining

Refer also to citation(s) 35561, 35596, 35597, 36239

35567 (CRL–88-26(TR)) **Data compilation report: strata deformation monitoring, No. 3 TBM tunnel, Donkin-Morien mine, N.S.** Aston, T.R.C.; Chipman, D.; Gallant, W.D. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Mar 1988. 67p.

This paper presents a data base compiled from geotechnical data, collected by extensometer, to monitor strata deformation in the tunnel crown at Donkin-Morien Mine No. 3. The data base contains comprehensive geotechnical and rock/support interaction information concerning large diameter TBM drivages through interbedded coal measures strata. 6 refs., 4 figs., 6 append.

35568 (CRL–88-34(TR)) **The application of rock bolt design methods to a proposed 7 West crosscut, Prince Mine, Sydney Coalfield, N.S.** Aston, T.R.C.; Gallant, W.D. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Jun 1988. 48p. Available from CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1.

This paper examines the use of rock bolting techniques as primary/secondary support systems for use in both temporary and permanent roadways. Data was input to eight different rock bolt design methods to compare results and determine the best rock bolting system for use in a proposed 7 West crosscut at the Prince Mine in the Sydney Coalfield. Results indicate none of the existing methods can provide a definitive rock bolt system for use in coal measures strata. However, three possible options for use in the 7 West crosscut are presented. 15 refs., 6 tabs., 10 figs.

35569 (CRL–88-36(TR)) **Statistical analysis of collected times between failure and times to repair of Easi-Miner at Obed Mine.** Szymanski, J.K.; Williams, C. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Jun 1988. 11p. Available from CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1.

A computer model was developed to simulate the operation of the Easi-Miner with trucks in open pit mines. Production data were collected over a period of one year at Obed Mine. This paper focuses on a statistical analysis of time to repair, and time between failures data of Easi-Miner operation. 1 ref., 4 figs.

35570 (CRL–88-41(TR)) **A preliminary pH analysis of coal slurries from the Sydney Coalfield, N.S.** Campbell, M.J.; Corbett, G.R.; Aston, T.R.C. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Jun 1988. 20p. Available from CANMET, 555 Booth St, Ottawa, Canada, K1A OG1.

In the process of examining the feasibility of using strata reinforcement techniques combined with overcoring to strengthen coal measures strata it was revealed that the settling characteristics of cement and chemical grouts was dependent on the pH of the host rock. This paper examines the pH conditions found in samples taken from three Sydney Coalfield mines. Results are largely presented in table and graph format. 2 refs., 4 tabs., 7 figs.

35571 (CRL–88-45(TR)) **Proposal for the development of a computerized guidance system for the Easi-Miner continuous mining machine.** Kempe, A.B.; Srajer, V. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Jul 1988. 19p. Available from CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1.

This paper proposes that a computerized guidance system for the 'Easi Miner' mining machine be developed. Factors affecting the accuracy of the system are identified and discussed. It is felt that the guidance system will improve the efficiency of the 'Easi-Miner' by reducing dependence on the operator's vision to distinguish between coal and waste, and through detection of significant changes in physical vibration of the miner while in operation. 6 refs.

35572 (CRL–88-48-(TR)) **Survey of microprocessor based performance monitoring devices in Canadian surface coal and oil sands mines in 1987.** Naidu, H.G. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Jul 1988. 16p.

This paper documents the results of a survey conducted by CANMET to determine the acceptance and industry experience of microprocessor based devices used for monitoring surface mining equipment. Current and future usage of these devices is discussed. Although the industry has begun to recognize the effectiveness of the monitoring equipment it was determined that except for a number of older units many of the devices in use were still being evaluated. 6 refs., 3 tabs., 2 append.

35573 (CRL–88-49(J,TR)) **The selection, development and testing of an integrated truck/shovel management system.** Srajer, V.; Hick, L.; Sadler, W. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Aug 1988. 22p. Available from CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1.

This study was based on data obtained from a number of Canadian coal mining companies. Requirements for an on-board data acquisition system were determined and an integrated truck/shovel operating and management system was then developed and tested. Components of the system include: a computer simulation program, a dispatching program, an equipment information system, a data transfer system, a database system and mobile equipment location devices. 5 refs., 4 figs., 2 tabs.

35574 (CRL–88-57(IR)) **Technical note on the construction of stoppings or dams in the Sydney coalfield.** Haslett, G.A. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Aug 1988. 25p. Available from CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1.

This report briefly reviews why and how stoppings or dams are constructed in underground coal mines. To be effective stoppings/dams must seal off the migration of air or gases from one side of the barrier to the other, and must provide adequate protection from any explosions that might occur within the sealed off workings. Stopping procedures and guidelines from Australia, the US, the UK, and the Federal Republic of Germany are mentioned. 6 refs., 3 tabs., 4 figs.

35575 (PB–89-163430/XAB) **High-performance, intrinsically safe data-acquisition system for underground use. Final report, October 1984-December 1984.** Van Scoy, R.J. Serata Geomechanics, Inc., Richmond, CA (USA). Dec 1988. 77p. Available from NTIS, PC A05/MF A01.

This report describes a portable, intrinsically safe data acquisition system designed specifically for use in underground coal mines. The system is designed for high resolution and stability, and can accept a wide variety of transducer types without modification or accessories. Input units may be easily added to the system to expand it to a maximum of 240 input channels. Up to one megabyte of measurement data can be recorded by the system's Data Logger, which uses internal solid-state memory. Stored data can be transferred directly via modem to a host computer or copied into another unit for transportation to the surface. A user-friendly menu system displayed on a hand-held terminal allows simple control of recording and data-transfer functions. All system units are designed to meet drop-test, watertightness, and other environmental criteria to enhance reliability in field use. The report includes photographs of the equipment and plots of data taken in laboratory and field tests. It also discusses system-design considerations, the electronic design of each system unit, and system firmware and documentation.

35576 (PB–89-166961/XAB) **Roofbolt support in board and pillar workings.** Merten, W.N. National Mechanical Engineering Research Inst., Pretoria (South Africa). Geomechanics Div. 23 Oct 1987. 11p. Available from NTIS, PC EE04/MF E04.

North American Continent sales only.

Roof-support requirements in board and pillar workings were examined. These investigations focused on the two problem areas of the influence of strata conditions on the behavior of different types of roof bolts, and the prediction of load-bearing capacities of mainly mechanically anchored expansion shell roofbolts. Both areas are interrelated through the strength of the rock strata, which has a distinct influence on the behavior of the different types of roof bolts.

0130 Transport and Handling

Refer also to citation(s) 35548, 35573

35577 (DOE/PC/90956–T8) **Advanced instrumentation for local measurement of gas-solid suspension flows: Quarterly technical progress report No. 9/10, November 1, 1988–April 30, 1989.** Ling, S.C.; Pao, H.P.; Zhang, X.S. Catholic Univ. of America, Washington, DC (USA). 1989. 18p. Sponsored by DOE Fossil Energy. DOE Contract FG22-86PC90956. Order Number DE89014437/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An advanced optical technique has been developed for the measurement of suspended-solid flows. This permits one to do more detailed experimental observations and analyses on the mechanics of sedimentary flows. In this study, the existence of micro-hairpin vortices as a major mechanism for the lifting of solid particles from the flow boundary has been identified. The lifting effect can be represented as a source term, the sedimentary flow problem may now be solved in a closed form, i.e., to have a steady-state solution. A preliminary parameterization for the problem is presented. 9 refs., 7 figs.

35578 (DOE/PC/90958–T8) **Studies of dense phase cohesive coal transport in plugs: Quarterly report, April–June 1989.** Klinzing, G.E. Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering. 1989. 15p. Sponsored by DOE Fossil Energy. DOE Contract FG22-86PC90958. Order Number DE89013683/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The experimental and analytical studies of horizontal transfer of pulverized coal in plug form were conducted in 2 inch PVC pipe for 15 feet of transfer. The pressure losses variation with plug and gas velocity were investigated and the operational parameters to obtain fine powder transported in a plug form were determined. It was found that the pressure drop across the plug behaved in exponential or linear fashions depending on the plug length. A model was proposed to predict the pressure drop across the plug and was found to agree within ±20 percent of the experimental results. 5 refs., 5 figs.

35579 (TVA/PUB–88/16) **Coal traffic on the Tennessee River Waterway to year 2000.** Navigation and System Modification, Knoxville, TN (USA). [1989]. 22p. Sponsored by Tennessee Valley Authority. Order Number DE89014204/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

The purpose of this paper is to examine the short-term future prospects for major industrial coal movements on the Tennessee River Waterway. The discussion centers on the historical and current volume of TVA coal and coal traffic of other major shippers that utilize the Tennessee River system as their primary means of transportation. Emphasis is placed on estimating future TVA Tennessee River coal traffic when nuclear power is restored and becomes the base load in the TVA power system. Export coal products are also briefly discussed. The paper is based on coal forecasts in the March 1988 "Commodity Traffic and Benefit Study for Navigation Improvements on the Upper Tennessee River," and information provided by TVA's Fossil Fuels Planning Branch. It should be useful in planning to meet the requirements of coal movements on the Tennessee River system to the year 2000. 8 figs., 2 tabs.

0140 Combustion

Refer also to citation(s) 35539, 37022

35580 (CONF-881202–4) **Contribution of dynamics and erosion for small tube arrays in fluidized beds.** Lyczkowski, R.W.; Bouillard, J.X.; Chang, Shen-Lin; Folga, S. Argonne National Lab., IL (USA). Feb 1989. 33p. Sponsored by DOE Fossil Energy. DOE Contract W-31109-ENG-38. From 5. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, Florida, USA; 12-14 Dec 1988. Order Number DE89013648/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The erosion issue in both atmospheric and pressurized fluidized bed combustors (AFBC's and PFBC's) has received increased attention in the last several years. The problem of erosion (more generally referred to as metal wastage) is so severe that in some cases the lifetime of tubes is as little as several thousand hours. The problem is international in scope and is hampering the commercialization of AFBC's and PFBC's for burning coal in a clean manner. The purpose of this paper is to discuss Argonne National Laboratory's (ANL's) current state-of-the-art computational capabilities in predicting erosion of fluidized bed tube arrays. Hydrodynamic calculations were performed for generic few tube approximations of the Coal Research Establishment's cold model erosion experiment. Predicted solids-gas velocities and void fractions, using FLUFIX computer code, were used as inputs to three erosion models — The monolayer energy dissipation erosion model, the extended Finnie impaction erosion model, and the combined ductile-brittle Neilson-Gilchrist erosion model — All erosion models predict order of magnitude agreement with each other and with liquid erosion data. However, the monolayer energy dissipation model produces more reliable trends of overall erosion rates. 31 refs., 12 figs., 1 tab.

35581 (DOE/MC/23253–2679) **Secondary atomization of coal-water fuels for gas turbine applications: Final report.** Yu, T.U.; Kang, S.W.; Beer, J.M. Massachusetts Inst. of Tech., Cambridge, MA (USA). Dec 1988. 101p. Sponsored by DOE Fossil Energy. DOE Contract AC21-86MC23253. Order Number DE89000970/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The main research objective was to determine the effectiveness of the CWF treatments on atomization quality when applied to an ultrafine coal-water fuel (solids loading reduced to 50%) and to gas turbine operating conditions (atomization at elevated pressures). Three fuel treatment techniques were studied: (1) heating of CWF under pressure to produce steam as the pressure drops during passage of the CWF through the atomizer nozzle, (2) absorption of CO_2 gas in the CWF to produce a similar effect, and (3) a combination of the two treatments above. These techniques were expected to produce secondary atomization, that is, disruptive shattering of CWF droplets subsequent to their leaving the atomizing nozzle, and to lead to better burnout and finer fly ash size distribution. A parallel objective was to present quantitative information on the spray characteristics (mean droplet size, radial distribution of droplet size, and spray shape) of CWF with and without fuel treatment, applicable to the design of CWF-burning gas turbine combustors. The experiments included laser diffraction droplet size measurements and high-speed photographic studies in the MIT Spray Test Facility to determine mean droplet size (mass median diameter), droplet size distribution, and spray shape and angle. Three systems of atomized

sprays were studied: (1) water sprays heated to a range of temperatures at atmospheric pressure; (2) CWF sprays heated at atmospheric pressure to different temperatures; and (3) sprays at elevated pressure. 31 refs., 47 figs., 1 tab.

35582 (DOE/PC/60419–T10) **Development of a pulsed coal combustor fired with CWM [coal-water mixture]: Phase 3, Final report.** Mansour, M.N.; Durai-Swamy, K. Management and Technical Consultants, Inc., Columbia, MD (USA). Nov 1986. 456p. Sponsored by DOE Fossil Energy. DOE Contract AC22-83PC60419. (MTCI–10011-RO178). Order Number DE89008271/JAW. Available from NTIS, PC A20/MF A01 - OSTI; GPO Dep.

This report presents the results of an R and D program aimed at developing a new burner technology for coal-water mixture (CWM) fuels to enable the substitution of these new fuels in utility and industrial boilers and process heaters currently firing oil and gas. The application of pulse combustion to CWM fuels is chosen to alleviate many of the physical plant and environmental constraints presently associated with the direct use of these fuels in equipment designed for oil and gas firing. Pulse combustion has been shown to be capable of high-intensity burning of coal for acceptably complete combustion within relatively small equipment volumes. It also has the inherent capability to agglomerate ash particles, thus rendering ash more easily separable from the combustion gas prior to its entrance into the convective section of the boiler or heater, thereby reducing ash buildup and pluggage. Pulse combustion is also well-suited to staged combustion for NO_x control and has excellent potential for enhanced in-furnace SO_2 removal due to the enhanced levels of mass transfer brought about by the vigorous flow oscillations. The primary objective of the Phase 2 work was to develop a detailed program for laboratory development and evaluation of the pulse CWM combustor and system design concepts. 112 refs., 40 figs., 94 tabs.

35583 (DOE/PC/79909–6) **Pyrite thermochemistry, ash agglomeration, and char fragmentation during pulverized coal combustion: Quarterly report, December 15, 1988–March 15, 1989.** Akan-Etuk, Nniefiok; Niksa, S.; Kruger, C.H. Stanford Univ., CA (USA). High Temperature Gasdynamics Lab. May 1989. 18p. Sponsored by DOE Fossil Energy. DOE Contract FG22-87PC79909. Order Number DE89013083/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the first quarter of 1989, we implemented the synthesis and classification procedures developed in past quarters to produce substantial amounts of samples for the pyrite thermochemistry studies. Two materials were generated, raw pyrite with relatively large mean sizes, for the studies of extraneous pyrite oxidation under simulated p.f. firing, and pyrite-loaded synthetic chars without macrovoids, for the studies of the oxidation of adventitious pyrite inclusions. Raw pyrite of a median size of 25 microns was produced with a two-stage classification scheme. Pyrite-loaded, non-macroporous synthetic chars were also produced. In the course of processing large amounts of samples, several potential improvements in the procedures were recognized, characterized, and implemented. Also, a new method to measure the pyrite loading was developed, to verify the loadings inferred from the density classification. 13 figs.

35584 (DOE/PC/88900–4) **An engineering model for coal devolatilization: Quarterly report, December 15, 1988–March 15, 1989.** Lau, Chun Wei; Niksa, S. Stanford Univ., CA (USA). High Temperature Gasdynamics Lab. May 1989. 14p. Sponsored by DOE Fossil Energy. DOE Contract FG22-88PC88900. Order Number DE89014559/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During this reporting period, we concentrated on our new theory for rapid coal devolatilization. This theory invokes flash distillation driven by competitive kinetics for depolymerization and reattachment to explain the influences of all important operating conditions. Its parameters which describe the initial configuration and molecular structure of coal are related to the structural characteristic which can be inferred from ^{13}C NMR analyses, so that the theory provides a basis for describing the devolatilization behavior of various coal types. At this point, however, the data correlations are restricted to Pittsburgh Seam HVA bituminous coals, for which data representing very broad variations in the opening conditions are available in the open literature. The data correlations included here represent variations in temperature to 1200K, heating rates from 1 to 10^3K/s, reaction times at constant temperature to 30 s, and pressures from vacuum to 25 atm. Obviously, such broad variations comprise a stringent validation of the theory, especially since the yields of gas and tar as well as the molecular weight distributions (MWDs)of tar are brought into the evaluations. The progress on the other aspects of this program is also reviewed, but briefly. Here we focus on a phenomenological description of the new devolatilization theory, and the evaluations against measured devolatilization behavior. 11 refs., 5 figs., 1 tab.

35585 (DOE/PC/88910–T1) **Detoxification and generation of useful products from coal combustion wastes: Quarterly technical report, [October–December 1988].** Arkansas Tech Univ., Russellville, AR (USA). Arkansas Mining and Mineral Resources Research Inst. 1988. 10p. Sponsored by DOE Fossil Energy. DOE Contract FG22-88PC88910. Order Number DE89014503/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This quarter, samples of dry fly ash, wet bottom ash, and desulfurization gypsum slurry were provided from an Ohio Edison power plant. Chemical analysis mineralogical examination, and an anion analysis were performed on the samples. 2 figs., 1 tab. (CBS)

35586 (DOE/PC/90753–T12) **Coal ash deposition, interaction with metal substrates and deposit build up: Summary report, 26 February 1989–25 May 1989.** Birks, N. Pittsburgh Univ., PA (USA). Dept. of Materials Science and Engineering. [1989]. 19p. Sponsored by DOE Fossil Energy. DOE Contract FG22-86PC90753. Order Number DE89014116/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the period covered by this report the effect of the presence of oxide phases and time of exposure to air + 1% SO_2 at 700°C were explored to determine how attack of the metal substrates by the ash deposits is initiated. The observations of cross sections of specimens 304 stainless steel exposed for 1, 2 and 4 hours to the above conditions are discussed. These observations taken at relatively short times are critical to the development of understanding of how the strong intergranular attack, previously reported for longer exposures, is initiated. 8 figs.

35587 (ERL–87-92(TE)) **Tube wastage in FBC boilers at Summerside - causes and resolution.** Razbin, V.V.; Friedrich, F.D. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Dec 1987. vp. Available from CANMET, 555 Booth St, Ottawa, Canada, K1A OG1.

Through a demonstration project at the fluidized bed combustor at the Canadian Forces Base Summerside, Prince Edward Island, it was determined that there was a definite operational problem due to erosion of the heat exchange surface exposed to the bed. This paper provides data on the metal wastage in the Summerside boiler, and steps taken to resolve the problem. Two configurations of protective hardware were found to be particularly effective - closely spaced pin studs on the waterwells, and longitudinal rods, five per tube, on the inbed tubes. This paper also describes a current experiment with the inbed tube bundle, which involves an alloy, two types of protective hardware, and a change in tube bundle. 3 refs., 5 tabs., 20 figs.

35588 (ERP/ERL–86-56(TR)) **Final report on the comparative combustion properties of raw and washed Prince Mine coal.** Banks, G.N.; Wong, J.K.L.; Whaley, H. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Sep 1986. 57p. Available from CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1.

Pilot scale combustion trials were conducted on a number of raw and cleaned coals. Chemical, physical, petrographic and thermogravimetric analyses were performed on the coal samples. Although, all of the coals ignited easily to produce stable flames at greater than 96% combustion efficiency, the highest combustion efficiencies (>99%) were obtained with the more finely ground coal feeds. The two washed coals with the lowest ash content gave the higher combustion efficiencies, however the raw coal which has the lowest fly ash combustible content, also gave a combustion efficiency greater than 99%. 2 refs., 20 tabs., 10 figs., 1 append.

35589 (ETDE-mf–9788276) **Process and system for combustion, especially of slow-reacting coal dust.** Bruecher, K.; Wenz, W. Gewerkschaft Sophia-Jacoba, Hueckelhoven (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Dec 1987. 93p. (In German). Order Number DE89788276/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

1.

Coal might well be a substitute for imported petroleum and natural gas on the heat, process heat, and district heating market if coal-fired plants with high efficiency and ease of servicing were available. In order to develop a burner for low-volatility coal dust, a cold state model was set up at Siemens/KWU and a high-temperature test burner at Gewerkschaft Sophia-Jacoba. The burner is equal to oil and gas burners in terms of comfort (on/off regime). Further investigations are required into dust removal from the dry ash, NO_x concentrations to be expected with bigger combustion chambers and higher wall temperatures in the afterburner, and flue gas desulphurization. These problems are to be solved during trial operation of a demonstration plant. (MOS).

35590 (PB–89-162374/XAB) **Report on the combustion of screened duff coal in a chain-grate stoker-fired boiler.** Engelbrecht, A.D. National Inst. for Coal Research, Pretoria (South Africa). 1987. 11p. Available from NTIS, PC EE04/MF E04.

North American Continent sales only.

The possibility of burning screened duff in a chain-grate stoker-fired boiler was investigated. It was decided to screen at -3 mm, since the -3 mm fraction of the coal causes the most problems during chain-grate stoker firing. Screening at -2 mm or even -1 mm could also reduce operating problems to acceptable levels, but it becomes very difficult to screen at these sizes. For the scheme to be feasible, some use will have to be found for the -3 mm fraction, viz. briquetting or small-scale P.F. firing on the same site. These aspects are currently being investigated. Several combustion trials as well as four fuel efficiency tests at 80% and 100% of MCR were carried out.

35591 (PB–89-180921/XAB) **Development of a vortex-containment combustor for coal-combustion systems. Report for January 1980-December 1983 (Final).** LaFond, J.F.; Heap, M.P.; Seeker, W.R.; Tyson, T.J. Energy and Environmental Research Corp., Irvine, CA (USA). Mar 1989. 120p. Available from NTIS, PC A06/MF A01.

See also DE88016249.

This report describes the development of a vortex-containment combustor (VCC) for coal-combustion systems, designed to solve major problems facing the conversion of oil- and gas-fired boilers to coal (e.g., derating, inorganic impurities in coal, and excessive formation of NOx and SOx). The system would: have a high firing density, separate and retain fly ash, and be adaptable to viable pollution-control technologies. An extensive literature review and tests of two candidate isothermal systems preceded the design and construction of a bench-scale VCC. Coal-combustion tests were performed on the VCC to evaluate its performance in terms of ash-retention efficiency, coal burnout, combustion stability, and slag and ash deposition. Results were very promising for both retention efficiency and combustion stability. Fuel-injector modifications improved internal slag-deposition conditions while maintaining acceptable carbon burnout levels. NOx control by staging and reburning technologies was evaluated in the VCC, along with sorbent injection for the control of SO_2 emissions. Both staging and reburning were effective in reducing NOx emissions in the VCC. Improvements in the sorbent injection approach are required to obtain an acceptable degree of SO_2 reduction. Based on particle force balance expressions, scaling criteria have been established for the VCC.

35592 (SAND–89-8241) **Coal combustion science: Quarterly progress report, January–March 1989.** Hardesty, D.R. (ed.). Sandia National Labs., Livermore, CA (USA). Jul 1989. 92p. Sponsored by DOE Fossil Energy. DOE Contract AC04-76DR00789. Order Number DE89013908/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Research on coal combustion is described. Research areas include: (1) Coal Devolatilization – The objective of this task is to characterize the physical and chemical processes that constitute the early devolatilization phase of coal combustion as a function of coal type, heating rate, particle size and temperature, and gas phase temperature and oxidizer concentration. (2) Coal Char Combustion – The objective of this task is to characterize the physical and chemical processes involved during coal combustion as a function of coal type, particle size and temperature, and gas temperature and oxygen concentration. (3) Fate of Mineral Matter During Coal Combustion – The objective of this task is to establish a quantitative understanding of the mechanisms and rates of transformation of mineral matter in coal combustion environments as a function of coal type, particle size and temperature, the initial forms and distribution of mineral species in the unreacted coal, and the local gas temperature and composition. A particular goal is determining the importance of fragmentation in the evolution of the particle size distribution during coal combustion. 23 refs., 38 figs., 23 tabs.

35593 (STEV-FBT–89-2) **Modelling of sulphur dioxide capture in fluidized bed combustion.** Lyngfelt, A. Statens Energiverk, Stockholm (Sweden). 1989. 16p. (CONF-8611288–: IEA and AFBC workshop on FBC mathematical modelling, Liege, France, 7 Nov 1986). Order Number DE89776265/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The paper discusses the relation between SO_2 models and comprehensive fluidized bed models. By comprehensive models is here meant complex models treating the hydrodynamics and combustion reactions in a fluidized bed. SO_2 models can be both independent models and component models in comprehensive models. The purpose of this paper is to illuminate the connection between SO_2 models and comprehensive models. The paper discusses: - what kind of information is exchanged between the SO_2 model and the comprehensive model. - to what extent the SO_2 model can be used as an independent model. - how an SO_2 model may be included in a comprehensive model. The situation can be summed up as follows: - The SO_2 models may be developed further without involving comprehensive models. - At present the role of a comprehensive model would be to supply the SO_2 model with data concerning lime particle residence times and attrition rates. - At a later stage of model development the SO_2 models may need to be included in comprehensive models in order to deal with phenomena of chemical nature. (46 refs.).

35594 (STEV-FBT–89-5) **Modelling of sulphur dioxide capture in fluidized bed combustion.** Lyngfelt, A. Statens Energiverk, Stockholm (Sweden). May 1986. 20p. Order Number DE89776262/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

There are two main objectives of increasing the understanding of limestone sulphation mechanism in fluidized beds by means of mathematical modelling . These are: - Prediction of the sulphur retention of a certain limestone in a given fluidized bed based on data for the limestone from laboratory tests. - Increasing the calcium utilization efficiency at a given calcium to sulphur ratio. The modelling in the present work is an attempt to find simple and logical model formulations. The basis in this modelling is the 'simple model'. In the simple model the degree of conversion of the lime is calculated as a function of only four parameters. These are: maximum degree of sulphation, X_{cc}, reaction rate constant, k, limestone average residence time, tau_c, and average sulphur dioxide concentration, c_s. A simple model has some important features: - It facilitates numerical solutions. - It provides a good basis for interpreting the result of more complex modelling. The simple model is applied in three ways to a two-phase fluidized bed reactor model. The first is at steady state with sulphur release in the emulsion phase. The second is at steady state with the sulphur dioxide already part of the gas entering the fluidized bed. The third is transient with respect to limestone feeding with sulphur released in the emulsion phase. (20 refs.).

0150 Marketing and Economics

Refer also to citation(s) 36256, 36271, 36272

35595 (LA-UR–89-1633) **Economics of selected energy applications of peat in Panama and Costa Rica.** Thayer, G.R.; Ramirez E., O.; Ramirez, A. Los Alamos National Lab., NM (USA). 1989. 15p. DOE Contract W-7405-ENG-36. (CONF-8903135–1:

Costa Rica symposium, San Jose, Costa Rica, 6-9 Mar 1989). Order Number DE89012613/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Studies were performed to determine the economic competitiveness of peat in Costa Rica and Panama. The cases examined were (1) electrical production in Panama, and (2) industrial boilers and cement plants in Costa Rica. Based on estimates of peat mining costs and the end-use costs we calculated for each application, the price of coal and oil at which the levelized life cycle cost of energy using peat was the same as that when coal or oil was used. We found that a peat-fueled power plant in Panama would be economic if the price of fuel oil was above $0.10 per liter and the cost of coal was above $40.00 per metric ton delivered. In Costa Rica, peat was competitive with fuel oil for large boilers (34,000 kg of steam per hour) when the cost of oil was above $0.10 per liter. For smaller boilers (5,000 kg of steam per hour) peat was cheaper than fuel oil when oil was above $0.08 per liter. Peat would be competitive in a cement plant when fuel oil prices were above $0.075 per liter. 5 figs.

0160 Health and Safety

Refer also to citation(s) 35834, 37647

35596 (ETDE-mf–9788274) **Improvement of work safety and strain reduction when equipping thin faces through the development and testing of a turning and swinging installation for shield support units. Final report.** Golomski, K.H. Ruhrkohle A.G., Essen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Dec 1988. 22p. (In German). Order Number DE89788274/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

When equipping the face the turning and swinging activity of shield support units, particularly in thin seams, represent a considerable strain. With a stoop the face team has to bring the shields into the right position at the installation point using heavy compressed air hoisting gear. The physical- and safety-related strain may be reduced by the use of a turning and swinging installation swinging the support units into the direction of face advance and secures them until they are safely staked against the roof. Thus a turning and swinging installation was developed and tested under this project. The installation met the requirements related to the swinging and securing process. Safety at the workplace was guaranteed. A strain reduction of the face team could be proven in an accompanying medical examination. (orig.) With 2 tabs., 10 figs.

35597 (INIS-mf–11457(v.1,2) v. 1) **Radon concentrations in air of Polish underground coal mines.** Chruscielewski, W. (Inst. of Occupational Medicine, Lodz (Poland)); Zorawski, A.; Olszewski, J.; Domanski, T. Canadian Nuclear Association, Toronto, ON (Canada). 1985. (CONF-841016–: International conference on occupational radiation safety in mining, Toronto, Ontario, Canada, 15-18 Oct 1984). In *Occupational radiation safety in mining. Proceedings of the international conference (in two volumes).* Order Number DE89619926/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

In all underground Polish coal mines the survey of radon concentrations was done. So-called environmental cassette system (ECS) with the passive track detector type Kodak LR-115 was used. The cassettes were placed in mines typical work-places, transportation roads and cross-adits for the time of 1 month. Altogether 870 measurements were performed in 71 underground mines. The mean radon concentration is 0.74 $kGq.m^{-3}$ with variability range from 0 up to 14.8 $kBq.m^{-3}$, occasionally. The paper presents the distribution of observed concentrations in each mine and also contains the authorised levels and limits actually used in Poland.

02 PETROLEUM

Refer also to citation(s) 35689

0201 Reserves

Refer also to citation(s) 35601

35598 (ETDE-mf–9788047) **Formation and development of deposits in salt strata. Final report.** Neugebauer, H.J.; Wallner, H. Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Inst. fuer Geophysik; Ministerium fuer Wissenschaft und Kunst des Landes Niedersachsen, Hannover (Germany, F.R.). 24 Nov 1987. 38p. (In German). Order Number DE89788047/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The tectonic development in a sedimentary basin and the resulting physical conditions as a cause of the mobility of hydrocarbons and salt rock are explained. Finally numerical calculation examples on the dynamism and thermionics of salt structures are discussed. They clearly show that stress and temperatures in connection with salt structures can be localized and that a mechanical loading of the surface rock by the salt leads to the formation of oil traps. The calculations explicitly describe the dynamic and thermal aspect of prospecting and focus the interest on the structure zone below great salt concentrations.

0202 Geology and Exploration

Refer also to citation(s) 36469

35599 (AOSTRA–8808, pp. 10) **The thick-getting mechanism and characteristics of terrestrial heavy oil pools in China.** Shubao, X. (RIPED, Beijing, China); Jiayu, N. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

In the oil-bearing basins of China, tectonic movements have caused some oil pools to be lifted or destroyed, and some to come into contact with hydrogeological systems. In these open systems, crude oils were biodegraded, washed and oxidized, forming a large quantity of heavy oil and oil sand deposits. Samples collected from Chinese oil fields, notably those in the Shuguang area, were selectively analyzed. Based on the analytical results and other geologic data, the mechanism for petroleum thickening, the types of heavy oil deposits, and their distribution, are discussed. The gradual changes in physical and geochemical properties of oil samples undergoing different levels of biodegradation and washing are observed and classified into five stages, with the chemical changes occuring in each stage described. Three typical types of heavy oil pools and their geological features are summarized systematically, along with descriptions of the types of geologic traps encountered. The spatially distributed style and structure of the open system of a basin controls the distribution of the various types of oil pools. The dustpan-like depressions of the Bohai bay basin are taken in this paper as an example in order to study this spatial distribution. 4 refs., 6 figs.

35600 (DOE/BC/14425–1) **Establishment of an oil and gas database for increased recovery and characterization of oil and gas carbonate reservoir heterogeneity: Technical progress report, April 19, 1989–June 30, 1989.** Mancini, E.A. Alabama Geological Survey, University, AL (USA). 1989. 12p. Sponsored by DOE Fossil Energy. DOE Contract FG22-89BC14425. Order Number DE89014843/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of this project is to augment the National Reservoir Database (TORIS database) and to increase our understanding of geologic heterogeneities that affect the recoveries of oil and gas from carbonate reservoirs in the State of Alabama and to identify those resources that are producible at moderate cost. This objective will be achieved through detailed geological, geostatistical, and engineering characterization of typical Jurassic Smackover Formation hydrocarbon reservoirs in selected productive fields in the State of Alabama. These studies will be utilized to develop and test mathematical models for prediction of reservoir heterogeneities. 3 figs.

35601 (DOE/EIA–0523(89/1Q)) **International oil and gas exploration and development activities: Quarterly report, First**

quarter 1989. USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas Statistics. 20 Jun 1989. 36p. Sponsored by DOE Management & Administration. Order Number DE89014438/JAW. Available from NTIS, PC A03/MF A01 - GPO - OSTI.

This is the second in a new series of quarterly reports prepared by the Energy Information Administration (EIA). The systematic tracking of international oil and gas exploration and development activities provides a means for monitoring the location and magnitude of significant new discoveries of oil and natural gas. This effort is intended to identify new sources of future oil and gas supplies. Specific information regarding the preparation or contents of this publication may be obtained from John H. Wood or Gary R. Long of the EIA Dallas Field Office; telephone (214-767-2200). 11 refs., 6 figs.

35602 Tectonism, subsidence, and fracturing of Mesaverde reservoirs in the Piceance basin, Colorado. Lorenz, J.C. (Sandia National Labs., Albuquerque, NM (USA)); Finley, S.J.; Norman, D.I. *AAPG (American Association of Petroleum Geologists) Bulletin (USA),* 72(2): 215 (Feb 1988). (CONF-880301–: Annual meeting of the American Association of Petroleum Geologists, Houston, TX, USA, 20-23 Mar 1988).

Cretaceous strata in the Piceance basin of northwestern Colorado were subjected to several phases of tectonic, burial, and uplift stress. However, extensive data on fractures in core from the US Department of Energy's Multiwell Experiment (MWX) wells suggest that most of the fractures in the Cretaceous strata in this part of the basin originated during one episode of stress. Time-depth relationships, fracture orientations, and fluid inclusion analyses all indicate that fracturing occurred about 35-40 m.y. during Laramide west-northwest horizontal compression. Most Cretaceous rocks at the MWX site contain a single set of west-northwest extension fractures. Isochore calculations indicate trapping pressures around 325 bars for fluid inclusions in 16 samples of quartz and calcite mineralization from the fractures, suggesting that mineralization occurred in a pressure-temperature regime compatible with the reconstructed burial depths of 10,000-12,000 ft. Younger episodes of stress are recorded in both the post-Cretaceous strata and in the less deeply buried Cretaceous strata near the basin boundaries. However, the effects of these younger stresses are not evident in deeply buried Mesaverde reservoirs at the MWX site in the east-central part of the basin. Moreover, if the orientation of the horizontal compressive stress rotated significantly during the late Laramide, as suggested by some authors, its effects are not apparent in the Cretaceous formations examined. Most measurements of ancient and present-day stress in Mesaverde strata at the MWX site indicate only west-northwest Laramide compression.

0203 Drilling and Production

Refer also to citation(s) 35599, 35600, 35653, 35691, 35700, 35722, 35723, 35725, 36467, 36469, 36471

35603 (AOSTRA–8808, pp. 27) **Experimental design for non-equilibrium immiscible carbon dioxide flood.** Lozada, D. (Univ. of Alberta, Edmonton, AB, Canada); Farouq Ali, S.M. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

This paper presents scaling criteria for designing immiscible carbon dioxide laboratory experiments for realistically simulating a given oilfield. A normal feature of the new scaling criteria is that they allow for partial, rather than complete, equilibrium among the oil, water and gas phases. Starting with the partial differential equation governing the flow of carbon dioxide, heavy oil and water, with partial equilibrium among the phases, a set of similarity groups is derived by inspectional analysis. New dimensionless groups for the explicit interface mass transfer parameters are derived. Six different approaches are presented for selecting the scaling criteria for a given type of experiments. For each case, the out-of-a-scale groups are tabulated. It is further shown by detailed example from the Alberfeldy-Lloydminster reservoir how an experiment is designed once a particular scaling approach is chosen. Guidelines are provided for choosing the experimental operating conditions for realistic simulation of field conditions. 17 refs., 2 figs., 16 tabs.

35604 (AOSTRA–8808, pp. 18) **Heavy oil recovery through immiscible displacement by carbon dioxide.** Murtada, H. (VEBA OEL AG., Gelsenkirchen, Germany); Meyn, V.; Hollerbach, A.; Swaid, I. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Selected results are presented from a laboratory program performed to assess the capability of carbon dioxide as a steam-additive to enhance the recovery of oil from a shallow Canadian heavy oil reservoir. Other objectives of the laboratory program were to study the mechanisms involved in displacing heavy oil by carbon dioxide and to generate reliable laboratory data on pressure-volume-temperature (PVT) behavior and recovery performance for the use in the numerical simulation. Special PVT and flood equipments were used for conducting the laboratory experiments at high temperatures and high pressures. In linear displacement experiments, effluent oil was analyzed to determine whether changes in the oil composition occurred when the heavy oil under study was displaced by carbon dioxide. At low flood velocity oil composition in the flood front differed substantially from that originally used to saturate the cores. A simple numerical model corroborates that displacement of heavy oil by carbon dioxide in a linear model is controlled by diffusion. 25 refs., 10 figs., 4 tabs.

35605 (AOSTRA–8808, pp. 9) **Laboratory examinations of a new downhole steam generator.** Spilrain, E.E. (Inst. of High Temperatures, Academy of Sciences, Moscow, USSR); Pinhasik, D.S.; Kachalov, V.V.; Granovsky, J.A.; Moscov, A.S.; Toth, M.; Magyar, M.; Laszlo, R.; Rakar, G. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

A new downhole steam generator system has been developed, the steam generating unit of which was manufactured in the USSR while the other equipment was manufactured in Hungary. Laboratory tests and experiments were carried out, including use of a well simulator, to examine various aspects of system performance prior to possible industrial application. The operating stability of the generating unit when using gas or liquid fuels was examined. The parameters necessary for establishment of the operational control and regulation system were determined in the case of field operation. The common operation of the steam generating unit and that of the well equipment connecting it to the hermetic cable connector, and the double packed packer, were tested. Further testing was carried out in a well simulator, and these investigations were expanded to the modelling of change in formation injectivity, and to the evaluation of the effect of pressure increase and fluctuation taken to the burning regime. The steam generator was found to operate with good stability with both gaseous and liquid fuels. Composition of the fuel mixture can be well controlled by monitoring the temperature of the exhausted steam. 7 refs., 11 figs.

35606 (AOSTRA–8808, pp. 11) **Use of slant drilling techniques for exploitation of Venezuela's shallow reservoir.** Marott, A. (Petroleos de Venezuela); Pina, R. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy*

crude and tar sands, vol. 2. Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Shallow heavy oil reservoirs in the Maracaibo and Orinoco regions of Venezuela have been exploited by the use of slant drilling. This technique has enabled recovery of heavy oil trapped beneath residential and agricultural areas, and has reduced the related drilling time and costs to the same level as for conventional vertical wells. Description of the drilling techniques and equipment includes details of the slant rig used. The rig includes a derrick inclinable to 45 degrees and hydraulic pipe handling and torquing systems. The slant rig was found to be more suitable than conventional vertical rigs for directional drilling in modules of up to 8 wells each, depending on pattern. 5 refs., 7 figs.

35607 (AOSTRA–8808, pp. 11) **Design and evaluation of pilot tests of steam soak with additives in Venezuela heavy oil reservoirs.** Ziritt, J.L. (PDVSA, Caracas, Venezuela); Rivas, O.; Bresolin, G. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Laboratory and field tests results are presented of steam soak with surfactant additives. Sixteen wells in the Bolivar Coast of Lake Maracaibo were steam-foamed using two commercial surfactants under different operating conditions. For the pilot test, wells were selected which covered different characteristics and stages of drainage in the Bolivar Coast. Parameters such as injection pressure surfactant concentration, presence of an electrolyte and a non-condensable gas and steam quality were changed during the test. Flowmeters were run with each set of conditions and results were evaluated by a mathematical procedure which gives the Steam Diversion Factor. Additionally, the actual production performance was compared with the predicted producton for a conventional cycle. Even though the production cycle of the steam-foamed wells has not been completed, results at present show an average incremental oil production of 24%. 7 refs., 10 figs., 2 tabs.

35608 (AOSTRA–8808, pp. 15) **Steam-CO_2 injection to recover heavy oil in limestones.** Guemrah, F. (Middle East Technical Univ., Ankara, Turkey); Okandan, E. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Research on combined use of steam and CO_2 was conducted on laboratory models of limestone saturated with heavy oil and water. Results obtained from the three dimensional laboratory model are presented. The Turkish crude oils used, Bati Raman with 12.5 API (American Petroleum Institute) and Camurlu with 11.1 API gravities had viscosities of 41 and 64 pascal-seconds at 20^0 C, respectively. The porous medium, composed of crushed limestone has 40% porosity, 29 darcy permeability as determined from linear models. Experiments were conducted at 75% oil and 25% water saturations. Cumulative oil recovery was 5.5-10% higher when CO_2 was injected simultaneously with steam compared to the steam only case. When comparison is made with recoveries obtained from linear models, the three dimensional flow effect caused about 60% decrease in the recovery. The amount of condensate collected from the second separator in the production line showed an increase when CO_2 was present together with steam. The densities of the light ends collected were lower than that obtained in steam injection, which indicated the better distillation effect of CO_2-steam on the in-situ oil. The steam front movement which is affected by the flow pattern indicated successive production peaks could be obtained, which is an indication of multiple contact between in-situ oil and injected steam-CO_2 mixture. The producton history as well as the change in the condensate densities showed this effect. 26 refs., 14 figs., 2 tabs.

35609 (AOSTRA–8808, pp. 27) **Ultrashort radius radial system. A new drilling and completion method for rapid development of oil sands reservoirs.** Dickinson, W. (Petrolphysics, Inc., San Francisco, CA, USA). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The technology, equipment, and field application of the ultrashort radius radial system for directional drilling is described. The system is capable of drilling and extended completion of stratified reservoirs for rapid and low-cost development by means of multiple radials. Most types of rock can be rapidly drilled at depth with the medium pressure water jet drills used with this system. Ultrashort radius whipstocks enable a 90 degree turn to be made in a 9-12 inch radius in both vertical and deviated wells. Closed loop control of the drill trajectory provides control while drilling in pitch, independent of roll; horizontal penetration rate is regulated by an independent hydraulic motion controller. Horizontal gravel packing, flexible slotted lining and electrochemical perforations have also been developed. Applications of multiple radials include steam injection, gravity drainage, multiple layers of production, and water coning control. Results are presented from field installations in California and show increases in productivity with lower operating costs. 9 refs., 22 figs.

35610 (AOSTRA–8808, pp. 8) **Rospo Mare, offshore Italy. An industrial development based on horizontal wells. Technical and economical aspects.** Bosio, J.C. (Elf Aquitaine, Paris, France). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Rospo Mare is an offshore oil field in 90m of water, with over 700 million barrels of oil in place. The pay zone is a tight and karstic calcareous formation, heavily fractured, with an active aquifer. Experience with vertical or tilted wells in this formation has indicated that they have low productivity and are quickly water-invaded by coning. A first horizontal well, drilled in 1982, had a productivity index over twenty times better than a vertical nearby well, and remained waterfree under a critical rate of 4000 bbl/d. Despite the low present price of heavy oil, production immediately became and remains today economical. A new platform has been installed and 5 new horizontal wells successfully drilled and put into production in 1987. Drilling, completion and production problems are described. An evolution of the costs is also presented, together with the recently decided plans for a new phase of development. Rospo Mare is the first industrial development of an offshore field based on horizontal wells only, and its results are encouraging for the future of this technique. 5 refs., 3 figs.

35611 (AOSTRA–8808, pp. 21) **New technologies in termal-recovery contribution of horizontal wells.** Combe, J. (Inst. Francais du Petrole, France); Burger, J.; Renard, G.; Valentin, E. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

A systematic investigation of cases for which the use of horizontal wells can improve the performance of thermal recovery by steam drive is presented. The cases studied by numerical simulation cover a wide range of fluid and formation characteristics, different spatial distributions for vertical and horizontal wells, as well as different injection strategies. The results are described in terms of oil production and costs; they are compared with the performances obtained by conventional development with vertical wells. It is shown that

horizontal well patterns are mainly attractive for thin, viscous-oil reservoirs, with low initial mobility, where steam drive, using vertical wells only, would be economically unprofitable or marginal. Moreover, well configurations combining vertical injectors and horizontal producers have specific advantages since they provide an accurate vertical description of the reservoir while taking benefit of horizontal production. Appropriate procedures of steam/drive application with horizontal wells in multi-layered formations are also shown to improve production performance. 13 refs., 11 figs., 5 tabs.

35612 (AOSTRA–8808, pp. 12) **Performance of first and second pilot cyclic steam stimulation projects in Kuwait.** Al Rabah, A.K. (Kuwait Oil Co.). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The heavy oil sand reservoir of Kuwait occurs at a shallow depth and contains a viscous and low American Petroleum Institute oil (ranges 11-15). Its reservoir temperature and pressure are generally low because of the shallow depth involved. The heavy oil reservoir has not yet been put into production by the primary recovery mechanism. To obtain an early answer on the suitability of a thermal process, two pilot projects for cyclic steam stimulation, each consisting of four wells, were initiated. The first cycle of the first pilot steam stimulation was started in September 1982 and concluded in March 1983. The first cycle of the second pilot project was started in June 1986 and concluded in August 1986. All eight wells are currently in production. Four wells showed natural flow exceeding five years with an average oil-steam ratio of 9.7. It is intended that two more steam injection cycles will be run at both pilots. In view of the favorable results obtained so far, steam soak projects have been expanded considerably since the start of the project. 21 additional wells in each pilot area have been drilled with a well spacing of 6 acres. These wells will be cyclic steam stimulated. 11 figs., 1 tab.

35613 (AOSTRA–8808, pp. 14) **The effects of well completion, steam injection and production practices on heavy oil production performance.** Ramsaran, A. (Trinidad and Tobago Oil Co. Ltd., (TRINTOC), Pointe-A-Pierre, Trinidad, West Indies). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

In July 1981, in Trinidad, a pilot steam injection project, the Parrylands Pilot Steam Project, was specifically designed and commissioned to determine the effects of well completion, steam injection, and production practices on production performance. Well completion designs were varied for production casing sizes, perforation densities, liner types and sizes, underreamed hole size, and the use of thermal packers, to determine an optimal well design for use in future expansions to exploit the heavy oil in place, which is estimated to be 80 x 10^6 m^3. The project consists of 18 wells drilled on a 1.0 hectare spacing. From the beginning of the project, 4 complete cycles of steam injection/production data are available for evaluation. The cumulative production from the project is 108 x 10^3 m^3, with an estimated ultimate oil recovery of 350 x 10^3 m^3. The current average production rate is 70 m^3/d. Under optimum operating conditions, production rates have fluctuated to within +/- 15% of the performance predicted with the Boberg and Lantz model for cyclic steam stimulation. Optimal well designs for injectors and offtakes have been used in two phases of expansion comprising 30 additional wells. Injectors are now routinely completed as cased hole gravel pack completions and the offtakes are completed as either open hole or cased hole gravel packs after log evaluation. The experience gained in the control of the steam injection parameters and production practices has resulted in a lower project operating cost and an increase of about 16 m/sup3//d for the project. 6 refs., 8 figs., 5 tabs.

35614 (AOSTRA–8808, pp. 14) **Estreito field study of reservoir for the extension of steam cyclic injection pilot projects.** Ribelo de Azambuja, A. (Petrobas, Rio De Janeiro, Brazil); de B. Regina, M.M.A. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The Estreito oil field is located at the border of the high block of the Carnaubais Fault, at the center of the Potiguar Basin, Brazil. The reservoirs belong to the medium Acu Formation and contain an estimated 54.5 million cubic meters (342.8 million bbl) of heavy oil (14 API) originally in place. This paper presents a summary of the rock and fluid properties. The production history, results of the steam pilot project, and the expansion of steam injection activities are discussed. The description of the simulators used are presented together with the problems that were encountered during the simulation. Finally, forecasted oil and water production data, and surveillance well data, are presented. 13 figs., 5 tabs.

35615 (AOSTRA–8808, pp. 10) **The Jobo Steamflood Project: A preliminary evaluation of results.** McGee, J. (Petroleos de Venezuela, Venezuela); Yibirin, J. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

This paper presents a description and a preliminary evaluation of results of the Jobo Steamflood Project, from start-up in March 1981 through December 1987. Despite the adverse presence of a strong natural water drive in this reservoir, which prevents pressure depletion by primary steam stimulated production, 41.5% of the original oil in place has been recovered, from an estimated final recovery of 45%. Steam breakthrough is expected to occur during 1989. Both optimum production and injection well completions, including insulating techniques, have been determined. Monitoring of the steam front has been very effective with the use of a combination of logs and radioactive tracers. Experience gained in the areas of production and injection well completion, as well as in surface facilities, will result in a more efficient development of conventional reservoirs and of the Orinoco Non-conventional, Heavy Oil Belt Field. The Jobo Field was selected because of the existing infrastructure and because rock and fluid properties are essentially identical to those prevailing in the Orinoco Belt. 6 refs., 6 figs., 2 tabs.

35616 (AOSTRA–8808, pp. 13) **Steam stimulation experience in Lake Maracaibo.** Romero, O. (LAGOVEN, S.A., Edo, Zubia, Venezuela); Arias, J. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

More than 50% of western Venezuela's remaining oil reserves are located in reservoirs found along the eastern coast of Lake Maracaibo. Most of these reserves are heavy oil with American Petroleum Institute gravities ranging from 11 to 20 degrees (0.993 to 0.934 specific gravity). The pay zones are at moderate depths, from 610m to 1,524m. Since 1965, wells in the major heavy oil reservoirs have been steam stimulated, resulting in considerable production increases and oil-steam ratios averaging 3.0 m^3/m^3. Since these reservoirs are located beneath Lake Maracaibo, steam is injected from barge-mounted generators with the capacity to inject two side-by-side wells simultaneously at an average pressure of 1,350 psi with 80% quality steam. Some unique features are associated with steam injection in Lake Maracaibo. Wells are thermally isolated in

situ with sodium silicate foam and are gas lifted during the production cycle. Since steaming began, modifications and innovations have been made to the original procedures in order to increase efficiency, reduce costs, and solve some problems. This paper reviews the steam stimulation experience in Lake Maracaibo and outlines the results to date and future plans. 10 refs., 13 figs., 1 tab.

35617 (AOSTRA–8808, pp. 8) **Feasibility of steam injection at 8200 feet.** Chacin, E. (S.A. MARAVEN, Langunillas, Zuila State, Venezuela, SA); Gomez, I.; Urdaneta, O.; Colonomos, P. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

During 1986 and 1987, a pilot cyclic steam tnjection test was carried out at Boscan Field in Venezuela. This project became a technical challenge for the industry because, for the first time, attempts were made to inject steam at depths exceeding 8000 ft. The objectives of the test were to determine the feasibility of injecting high quality steam at a depth of 8200 ft, and to analyze the response of the reservoir to steam stimulation. In order to obtain high quality steam at the bottom of these wells, it was necessary to inject steam through a pre-insulated tubing that assured a minimum (5%) heat loss throughout the 8200 ft. and, at the same time, could maintain tensile stress requirements. The pilot test was carried out in two wells of the Boscan Field. The production increase obtained on both wells was 38%. The reason for this low increase has not yet been determined, but there is an indication of the presence of severe damage on the formation, due to the effect of asphaltenes, coke deposits, or emulsions. The injection of steam, however, was a successful operation, which gave useful experience for the future of Boscan Field as well as for other similar reservoirs in Venezuela and other countries that produce extra heavy crude oil from deep reservoirs. 4 figs., 1 tab.

35618 (CHOA–8704) **Optimizing heavy oil production through innovative techniques. Proceedings [of the] fourth quarterly meeting of the Canadian Heavy Oil Association.** Canadian Heavy Oil Association (Canada). 1987. vp. (CONF-8704381–: 4. quarterly meeting of the Canadian Heavy Oil Association, Calgary, Canada, 28 Apr 1987;CE–02641). Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

In a meeting which presented papers on techniques and equipment used in heavy oil production, the topics included sucker rod string accessories, abrasive slotting of well casings, composite media prepacks for sand control, and a new type of travelling valve for rod pumps. Separate abstracts have been prepared for four papers from this meeting.

35619 (CHOA–8704 VP) **Abrasive slotting of casing for use in heavy oil well completions and workovers.** Kelly, J. (Halliburton Services Ltd., Calgary, AB, Canada). Canadian Heavy Oil Association (Canada). 1987. (CONF-8704381–: 4. quarterly meeting of the Canadian Heavy Oil Association, Calgary, Canada, 28 Apr 1987;CE–02641). In *Optimizing heavy oil production through innovative techniques. Proceedings [of the] fourth quarterly meeting of the Canadian Heavy Oil Association.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

Pumping an abrasive medium carried in a formation-compatible fluid, under high pressure (abrasive jetting), in order to perforate and/or simulate heavy oil wells offers many advantages compared to conventional techniques. The basic tool design consists of two tungsten carbide jets spaced 180 degrees apart, and in operation, nitrogen is added to the jetting fluid to reduce hydrostatic back pressure and enhance the cutting action. Areas of application include casing perforation, fracture initiation, well cleanout, sand control, pipe recovery, and stimulation. A set of criteria for the work string, treating fluid, casing and wellhead, nozzle size, return tank and transfer pump, and other factors are outlined for performing an abrasive jet operation. Some performance data are presented for a project carried out in Alberta. 4 refs., 5 figs., 3 tabs.

35620 (CHOA–8704, pp. 4) **New solutions to oil problems in pumping heavy oil.** Adair, J. (Harbison-Fischer Canada, Ltd., Calgary, AB, Canada). Canadian Heavy Oil Association (Canada). 1987. (CONF-8704381–: 4. quarterly meeting of the Canadian Heavy Oil Association, Calgary, Canada, 28 Apr 1987;CE–02641). In *Optimizing heavy oil production through innovative techniques. Proceedings [of the] fourth quarterly meeting of the Canadian Heavy Oil Association.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

Problems in heavy oil pumping include gas lock, steam flashing, solids carried in the viscous fluids, fluid pound, and plunger fall (also known as rod fall). To address these associated problems, a mechanically-actuated travelling valve has been introduced to eliminate gas lock and minimize fluid pound and fluid drag on the travelling assembly. The new device, called the No-Loc Plunger, was primarily designed for operations in low-fluid-level wells and wells producing with a high gas-to-oil ratio. The design of the valve is based on opening the traveling valve on the downstroke, thereby transferring the entire fluid load to the standing valve. Flow capacity is increased due to the valve design having the drop placed outside of any flow-restricting cape or shell. The shape of the drop is such as to minimize drag, and the seat, being integrated into the plunger sleeve, permits the largest possible internal dimensions that can be achieved. The No-Loc is available for all sizes of rod insert and tubing pumps.

35621 (CHOA–8704, pp. 15) **Composite media prepacks for sand control in heavy oil production.** Scott, L. (Sherritt Gordon Mines, Ltd.); Parker, P. Canadian Heavy Oil Association (Canada). 1987. (CONF-8704381–: 4. quarterly meeting of the Canadian Heavy Oil Association, Calgary, Canada, 28 Apr 1987;CE–02641). In *Optimizing heavy oil production through innovative techniques. Proceedings [of the] fourth quarterly meeting of the Canadian Heavy Oil Association.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

In a field test study in the Cold Lake area, four different filter media materials in new modular prepacks were evaluated as means of sand control in heavy oil production. After removal from the well and evaluation of the filter modules and the filter materials, it was concluded that one material, a chromium clad steel medium (cr-Fe shot), was particularly well suited for this application. This filter material withstood the main downhole environment and maintained good permeability through production and steam injection cycles during testing. In combination with the wire wrapped screen container module, this medium constitutes an improved form of sand control for the heavy oil industry. The modular prepack allows flexibility of design in terms of annular pack thickness, media size range and wire wrap spacing; the modular design allows installation ease, accuracy of sand control placement in the bore hole and recovery of the filter segments. 6 figs., 3 tabs.

35622 (CHOA–8704, pp. 41) **Optimize profits with Diversified Drilling Services Ltd.** Canadian Heavy Oil Association (Canada). 1987. (CONF-8704381–: 4. quarterly meeting of the Canadian Heavy Oil Association, Calgary, Canada, 28 Apr 1987;CE–02641). In *Optimizing heavy oil production through innovative techniques. Proceedings [of the] fourth quarterly meeting of the Canadian Heavy Oil Association.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

The problems caused by tubing, rod, and rod coupler wear and failures have been addressed by development of a series of anti-friction coupling products described in this paper. Characteristics, performance, and costs of three products are given: a wheeled sucker rod centralizer, in which the wheels are so arranged that no metal contact is possible whatever direction the rod couplings are oriented; a sucker rod stabilizer designed for wells using rotating rod strings and screw pumps; and a coated sucker rod centralizer to be used in conjunction with the second device. Case studies are used to illustrate the benefits of the use of this type of equipment, notably in deviated holes, direction wells, slant wells and high sand

content reservoirs. These studies show advantages including reduction of rod loads and rod hangups, elimination of rod and tubing wear, and significant increases in production. 34 figs., 4 tabs.

35623 (CHOA–8808, pp. 16) **Reducing wellbore heat loss.** Meldau, R.F. (Dolphin Petroleum Consultants, Canada). Canadian Heavy Oil Association (Canada). 1988. (CONF-8808237–: Thermal well completions seminar, Edmonton, Canada, 11 Aug 1988;CE–02660). In *Thermal well completions seminar.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

Even small reductions in heat lost from steam injection wells can save thousands of dollars every day, because generating steam is the most expensive part of thermal oil recovery. Some aspects of the complex flow of steam vapor and condensate in injection wells are not generally understood, though this greatly affects heat transfer to the casing wall. Properly designed and installed insulated tubing is expensive, but can dramatically reduce heat loss in steamflood injectors and deep cyclic steam wells. The industry needs a practical technique to measure wellbore heat loss, and thus better decide when to upgrade the completion, calibrate computer prediction models, and learn how insulated tubing is performing with time. Five different methods of measurement, three of which are field tested, are presented. Downhole steam generators eliminate wellbore and steam generator heat loss, but the risk of expensive workovers or well loss seems high; their field use to date is therefore limited. 26 refs., 15 figs., 2 tabs.

35624 (CHOA–8808, pp. 27) **Analysis of thermal well pumping performance at the Norcen-Bodo steam pilot.** Wong, A. (Alberta Oil Sands Technology and Research Authority, AB, Canada); Frankiw, K.E. Canadian Heavy Oil Association (Canada). 1988. (CONF-8808237–: Thermal well completions seminar, Edmonton, Canada, 11 Aug 1988;CE–02660). In *Thermal well completions seminar.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

The Bodo Steam Project is operated by various partners, including Norcen Energy Resources and the Alberta Oil Sands Technology and Research Authority (AOSTRA). This paper presents a study conducted by Norcen and AOSTRA engineers to diagnose the interference steam and non-condensable gases rod-insert bottomhole pumps, and to develop solutions to in improve pump efficiency and well draw-down. The paper describes the bottomhole pump, the model for predicting pump efficiency in the presence of vapors, and the effect of lowering pump landing depths, of applying a fixed casing head pressure, and of injecting water. Dynamometer cards were used to study pump stroking conditions. An equation of state model (Peng-Robinson) is successfully applied to predict the vapor interference effect on pump performance, and a set of charts is presented to allow the operations personnel to apply the pump efficiency prediction model. 4 refs., 16 figs., 3 tabs.

35625 (CHOA–8808, pp. 16) **Thermal completions for radial production systems.** Dickinson, W. (Petrolphysics, Inc., Canada); Wilkes, R. Canadian Heavy Oil Association (Canada). 1988. (CONF-8808237–: Thermal well completions seminar, Edmonton, Canada, 11 Aug 1988;CE–02660). In *Thermal well completions seminar.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

Most thermal wells involve unconsolidated formations, high viscosity crude oil, and low reservoir pressure. Radial wells improve access for steam into the formation and facilitate oil movement to the vertical well bore. However, the completion of horizontal or radial wells can be more costly and complicated than the drilling process itself. The Ultrashort Radius Radial System (URR) was developed to reduce the cost of horizontal drilling and to permit gravity feed into a vertical sump and pump. The system is really an extended completion system or set of long piped perforations. Multiple radials on multiple levels may also be provided. Three thermal completion options have been developed for the URR: horizontal gravel packing, which uses two separate lifts of gravel to produce 100% fill; flexible perforators, which provide about 120 simultaneous perforations in 1/2 h; and flexible slotted liners, which can be placed around the ultrashort radius. All three thermal completion options may be applied separately or in combination. Initial field results indicate that wells having horizontal radials exhibit higher production rates, longer time between workovers, and better efficiency of steam utilization. 14 refs., 8 figs.

35626 (CHOA–8808, pp. 10) **Gravel pack equipment requires special design for thermal recovery.** Weirich, J.B. (Baker Sand Control U.S.A.); Zaleski, T.E. Canadian Heavy Oil Association (Canada). 1988. (CONF-8808237–: Thermal well completions seminar, Edmonton, Canada, 11 Aug 1988;CE–02660). In *Thermal well completions seminar.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

Successful gravel packed completions in thermal recovery wells depend upon proper design and selection of downhole equipment. Gravel pack equipment designed for normal geothermal environments will generally lack the strength necessary to maintain satisfactory performance in a thermal well completion. Since the equipment would not be subjected to large temperature changes, thermal generated forces do not need to be considered or accommodated in standard applications. This paper discusses design criteria for the selection of gravel pack equipment for thermal recovery wells. The theoretical approach to the problems is supplemented with both experimental and field results. 9 refs., 5 figs.

35627 (CHOA–8808, pp. 10) **Investigation of a premium casing connection for Canadian thermal recovery wells.** Slack, M.W. (Centre for Frontier Engineering Research, Canada); Kaiser, T.; Beaulac, G. Canadian Heavy Oil Association (Canada). 1988. (CONF-8808237–: Thermal well completions seminar, Edmonton, Canada, 11 Aug 1988;CE–02660). In *Thermal well completions seminar.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

A test procedure to evaluate casing connections for Canadian thermal recovery wells is derived from current design assumptions and applied to candidate specimens. Seal surface contact pressures are presented as assessed numerically by finite element analysis and experimentally by direct measurement using a recently developed technique. The importance of considering both temperature and time dependence of material mechanical properties is demonstrated. The test procedure described is designed to evaluate both mechanical strength and seal integrity under realistic combinations of load and temperature. 8 figs., 1 tab.

35628 (CHOA–8808, pp. 37) **Sand control with geotextile filters.** Scott, J.D. (Univ. of Alberta, Edmonton, AB, Canada); Kerr, N.; Richards, E.A.; Martin-Scott, S.Y. Canadian Heavy Oil Association (Canada). 1988. (CONF-8808237–: Thermal well completions seminar, Edmonton, Canada, 11 Aug 1988;CE–02660). In *Thermal well completions seminar.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

Sand flow is a major problem in many production wells founded in heavy oil and oil sands unconsolidated sand formations. Well filters such as slotted liners, screens, and gravel packs often have plugging and erosion problems in the harsh environments that occur in thermally stimulated projects in this type of reservoir. The objective of this paper is to discuss how a longer lasting and more efficient filter can be designed by applying the technology recently developed in two fields: geotechnical engineering and polymer science. Recently, woven and nonwoven geotextiles have been developed as filters for underground drainage systems and water wells. These innovations, combined with high technology textiles, can be applied to filtration for oil wells and offer a potential improvement over current filter systems. In thermally stimulated wells, a filter must withstand high temperatures and highly alkaline conditions, while maximizing oil fluid flow and minimizing sand production. Geosynthetic filters possess many advantages over conventional filters: large surface area, high porosity and permeability, a pore size distribution tailored for the formation sand, and, in geocomposites, both good filtration and in-plane flow properties. 65 refs., 26 figs., 4 tabs.

35629 (CU/FCE–8903, pp. 24) **The role of combustion gases in recovering oil in in-situ combustion processes.** Erno, B.P. (Nova Husky Research Corp., Calgary, AB, Canada). Calgary Univ.,

AB (Canada). Faculty of Continuing Education. 1989. (CONF-8903126–: 6. annual heavy oil and oil sands technical symposium, Calgary, Canada, 8 Mar 1989;CE–02591). In *Challenges and innovations 1989. 6th Annual heavy oil and oil sands technical sypmposium.* Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

Due to its applicability in reservoirs not suitable for other enhanced oil recovery (EOR) applications, in-situ combustion is considered to be one of the most widely applicable EOR techniques. This work attempts to quantify the role of combusiton gas mixtures in oil recovery by in-situ combustion. A series of core flood tests were performed using combustion gases simulating both air and oxygen fire floods in the presence of reservoir oil and sand. Core flood experiments were conducted to study the effect of temperature ranging from 50 to 200^{0}C. Gas injection was carried out at different flow rates in order to simulate different flow regimes. The results indicate that recovery efficiency depends largely on the flow regime prevailing, indicating the importance of flow rate controlled fire flood schemes. Changing the gas composition from rich in nitrogen (as produced from air combustion) to rich in carbon dioxide (oxygen combustion) had some impact on oil recovery. Another series of runs was conducted to investigate the impact of hot water injection following an initial gas flood. In the cases studied, the injection of hot water following a gas flood gave much higher recovery than waterflood alone, showing the superiority of the sequential flow of gas and water as opposed to dry gas drive or hot water drive ahead of the fire front. 10 refs., 9 figs., 5 tabs.

35630 (CU/FCE–8903, pp. 17) **Cold Lake artificial lift optimization.** Elgert, B.D. (Esso Resources Canada, Ltd.); Chambers, N.A.; Suzuki, F. Calgary Univ., AB (Canada). Faculty of Continuing Education. 1989. (CONF-8903126–: 6. annual heavy oil and oil sands technical symposium, Calgary, Canada, 8 Mar 1989;CE–02591). In *Challenges and innovations 1989. 6th Annual heavy oil and oil sands technical symposium.* Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

Short downhole pump runlife in Esso's Cold Lake operation results in high pump repair and well servicing costs and lost or deferred production. The primary causes of pump failure were identified as sand related failures occurring shortly after the flowback stage and scale related failures occuring throughout all production stages. Two methods of improving pump runlife in Cold Lake were identified and implemented, based on these primary causes of pump failure. The first method involves controlling flowrates during the high energy, flowback stage using choke operating guidelines. This method focuses on reducing the rate of sand production into the wellbore during the flowback stage. The second method involves the use of chrome plated barrels and spray metal plungers, in place of carbon steel barrels and chrome plated plungers, in Cold Lake rod insert pumps. This method focuses on the improved scale resistance of chrome plated surfaces to Cold Lake produced fluids. Although both methods use existing, low cost production technology, early results suggest that these methods will result in a significant improvement of pump runlife in Cold Lake. 11 figs., 1 tab.

35631 (CU/FCE–8903, pp. 15) **Horizontal well application in the Pelican Lake and winter reservoirs.** Coffin, P. (CS Resources Ltd.). Calgary Univ., AB (Canada). Faculty of Continuing Education. 1989. (CONF-8903126–: 6. annual heavy oil and oil sands technical symposium, Calgary, Canada, 8 Mar 1989;CE–02591). In *Challenges and innovations 1989. 6th Annual heavy oil and oil sands technical symposium.* Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

This paper briefly reviews the history of horizontal wells and their different applications. The two heavy oil horizontal well projects undertaken in Canada by CS Resources Ltd. in 1988 are presented. Ten horizontal wells were drilled, totalling a horizontal drilling meterage over 5,000 metres, and produced. Both cost and early production results are very encouraging. 6 refs., 6 figs., 2 tabs.

35632 (DOE/BC/14204–2) **Cyclic CO_2 injection for light oil recovery: Performance of a cost shared field test in Louisiana: Second quarterly report, 21 February–21 May 1989.** Monger, T.G. Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Petroleum Engineering. 1989. 7p. Sponsored by DOE Energy Research. DOE Contract FG22-89BC14204. Order Number DE89014217/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The ultimate objective of this research is to provide a base of knowledge on the CO_2 process for the enhanced recovery of Louisiana crude oil. First year goals of the project include laboratory corefloods to investigate several parameters important to the process, and numerical simulation to interpret coreflood results. Additional activities include construction of a field test data base, and development of a radial core setup. Second and third year goals include evaluation of field tests performed by the private sector, in conjunction with implementation of Department of Energy sponsored field tests. The results of all laboratory and field evaluations will be made available to the industry through one or more workshops. Results are briefly reported.

35633 (DOE/FE–0135) **Enhanced oil recovery program plan: FY 1989.** Department of Energy, Washington, DC (USA). Assistant Secretary for Fossil Energy. Jun 1989. 40p. Sponsored by DOE Fossil Energy. Order Number DE89013909/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

These reports provide solid evidence of the need for an aggressive R&D program to increase the recovery of domestic oil. They also highlight the need to integrate the development of advanced technologies with private sector initiatives and to obtain an industry perspective on future research needs. This document is structured so that the two major components of the program, reservoir characterization research and advanced EOR technology development are described individually; but they are indivisible parts of the program that complement each other. Specific objectives are presented. 11 refs., 9 figs., 1 tab.

35634 **Influence of natural fractures on hydraulic fracture propagation.** Teufel, L.W.; Warpinski, N.R. vp.American Association of Petroleum Geologists, Tulsa, OK (1988). (CONF-880301–: Annual meeting of the American Association of Petroleum Geologists, Houston, TX, USA, 20-23 Mar 1988).

Hydraulic fracturing has become a valuable technique for the stimulation of oil, gas, and geothermal reservoirs in a variety of reservoir rocks. In many applications, only short fractures are needed for economic production. In low-permeability reservoirs, however, long penetrating fractures are generally needed, and in this case, natural fractures can be the cause of many adverse effects during a fracture treatment. Natural fractures can influence the overall geometry and effectiveness of the hydraulic fracture by: (1) arresting the vertical or lateral growth, (2) reducing total fracture length via fluid leakoff, (3) limiting proppant transport and placement, and (4) enhancing the creation of multiple or secondary fractures rather than a single planar hydraulic fracture. The result may range from negligible to catastrophic depending on the values of the ancillary treatment and reservoir parameters, such as the treating pressure, in-situ stresses, pore pressure, orientations of the natural fractures relative to principle in-situ stresses, spacing and distribution of the natural fractures, permeability, etc. Field observations from mineback experiments at DOE's Nevada Test Site and the multiwell experiment in Colorado, laboratory tests, and analyses of these data are integrated to describe the complex fracture behavior found to an provide guidelines for predicting when this complex fracturing occurs.

0204 Processing

Refer also to citation(s) 35521, 35523, 35526, 35546, 35664, 35705, 35712

35635 (AOSTRA–8808, pp. 17) **Reaction mechanism in Vis-ABC process.** Takatsuka, T. (Chiyoda Corp., Kanagawaku, Yokohama, Japan); Wada, Y.; Nakata, S.-I.; Komatsu, S.-E. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta

Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Among the various residue upgrading processes in use, conventional HDS units operated at elevated temperature are widely employed for cracking inferior crudes with a high metal content, such as Middle East or South American Crude. Such a high temperature operation results in inducing dry sludge formation in product oil and maximum conversion is regulated by that limitation. In the VisABC process–a combination of hydrovisbreaking and hydroconversion by ABC catalyst–the maximum conversion was improved by as much as 15% for inferior crudes. The advantage of the higher conversion in the VisABC process is demonstrated by characterizing the reaction mechanism in the process. A reaction mechanism model and compatibility prediction modes were developed for the prediction of the maximum conversion in this process. Results indicate the process to be an excellent tool, if calibrated further, to optimize various types of residual hydroconversion processes. 5 refs., 13 figs.

35636 (AOSTRA–8808, pp. 21) **ASVAHL new routes for prosessing heavy oils.** Peries, J.P. (Inst. Francais du Petrole-CEDI, France); DesCourieres, T.; Renard, P.; Rossarie, J. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Heavy crudes are characterized by their low atmospheric distillate content and their structure that is rich in polyaromatics, resins and asphaltenes. As a result, they raise problems of recovery from the field, transportation and refining. ASVAHL has investigated the desalting of heavy crudes. To solve the transportation problem, ASVAHL proposes to decrease the viscosity by various thermal processes (TERVAHL T visbreaking, TERVAHL H.-hydrovisbreaking and TERVAHLC catalytic hydrovisbreaking, and TERVAL C catalytic hydrovisbreaking). Two refining routes have been developed. An indirect one using the SOLVAHL heavy-solvent deasphalting process to prepare feedstocks for conventional conversion plants, and a direct one using the HYVAHL process for the catalytic hydrotreatment of residues. For the upgrading of heavy crudes, ASVAHL has made associations of different TERVAHL, SOLVAHL and HYVAHL processes and their variants in a processing scheme both on the field and in the refinery. Technical solutions for all problems, ranging from transportation alone to deep conversion, from the use of bitumen to transformation into the maximum amount of low-sulfur fuel oil, have been tested on a large scale. The principal characteristics of the products, distillates or residues are described and compared to standard specifications for cuts such as fuels or bitumens or to the characteristics required for conventional refining products that may be found downstream. The different schemes - SOLVAHL alone, TERVAHL HC alone, TERVAHL HC + SOLVAHL, TERVAHL H + HYVAL - are compared from the viewpoint of conversion to light products, and reduction of the amount of fuel oil, for a Canadian and a Venezuelan heavy crude. 6 figs., 10 tabs.

35637 (AOSTRA–8808, pp. 15) **Mild resid hydrocracking for heavy oil upgrading.** Sice, H. (Idemitsu Kosan Co. Ltd.); Sekino, M; Yoshimoto, M.; Armstrong, R.B.; Klein, B. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

An intermediate approach for heavy oil upgrading, employing hydrogen addition at moderate pressure with a low-cost catalyst, has been developed. The process, called mild resid hydrocracking (MRH), has been implemented in a 10 bbl/d pilot plant constructed in 1985, and is described in this report. Over 5000 hours of operation have confirmed the reliability and performance of MRH, and sufficient data on yield, hydrogen consumption, and catalyst performance has been produced to support ongoing economic studies to verify the attractiveness of the process for heavy oil upgrading. The principal advantages of MRH are low operating pressure (60-80 bars hydrogen partial pressure), inexpensive catalyst (spent fluid catalytic cracking catalysts can be used), high quality distillate product, and low hydrogen consumption. Feedstocks have included heavy Arabian vacuum resid and Canadian oil sands bitumen. 11 figs., 5 tabs.

35638 (AOSTRA–8808, pp. 9) **Upgrading of heavy crude at low-temperature and ambient-atmosphere.** Lee, A.S. (Univ. of Southern California, Los Angeles, CA, USA); Xu, X.W.; Yen, T.F. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

It has been found that the heavy fractions of crude oil, asphaltene and preasphaltene, can be converted into oil and resin fractions in an alkaline aqueous solution at low-temperature and ambient-atmosphere. A substantial reduction (up to 50 wt%) of heavy asphaltic fractions makes the heavy crude oil virtually free of asphaltene and metal, with a significant decrease of viscosity. The treated crude oil is upgraded to lower density with a high recovery (up to 99% based on carbon content). Lighter crude oil separates and collects as a layer on the surface of the aqueous solution, which is then recovered and recycled. This new method utilizes the acid-bearing functional group from the heavy asphaltic fractions which react with cations, such as sodium ions in the alkaline aqueous solution, to develop surfactants. With the application of ultrasonic energy, monolamellar vesicles are formed. These monolamellar vesicles work as catalysts in carrying free radicals, such as hydrogen atoms and hydrated electrons which are generated by the cavitation effects of ultra-sonication. These radicals activate hydrogenation in the surfactant vesicle and, in turn, upgrade the heavy crude oil. At the low-temperature (55^0C) and ambient atmosphere operating conditions of this process, the energy consumption is extremely low as compared to the refining technology in existence. 13 refs., 1 fig., 3 tabs.

35639 (AOSTRA–8808, pp. 6) **Angelov/Shibley process improves economics of processing heavy oil.** Angelov, G. (Bitech Energy Resources Ltd., Willowdale, ON, Canada); Shibley, P.W.M. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Conversion of heavy oil to light sweet synthetic crude is technically feasible but not economically viable in today's market. By optimizing treatment processes and applying partial desulphurization, heavy oil can be moved to important utility fuel markets at acceptable prices. Process selection for such a scheme is important. Initial handling and treatment costs must be controlled while preparation for desulfurization must be simple and effective. The Angelov/Shibley process described in this paper satisfies these criteria by combining the functions of de-emulsification, de-watering, de-salting and pentane de-asphalting. The deasphalted oil from pentane de-asphalting is easily and economically desulfurized to satisfy the utility fuels market. This is potentially a large market which could stimulate significant development of heavy oil. The asphaltenes rejected by deasphalting can readily be disposed of as coal fines binder. 4 refs., 1 fig., 2 tabs.

35640 (DOE/EIA–M037) **Refinery yield model spreadsheet system (RYMSS) documentation.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. Apr 1989. 51p. Sponsored by DOE Management & Administration. Order Number DE89012629/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This document provides a description of the model logic and database associated with Version 1 of the Refinery Yield Model Spreadsheet System (RYMSS). The database consists of data

tables which describe model input and yield data, including the definition of data elements, data sources, and units of measurement. This database documentation is expected to be useful for economists (or the equivalent professional skill level) who are interested in performing refinery analysis using RYMSS. In addition, this documentation can serve as a tutorial for potential operators of the model. This document is divided into five chapters. The first two chapters present an overview of the model and its structure. The following two chapters present the model inputs/control variables and yield data tables, respectively. The final chapter presents the data tables associated with product blending. 7 figs., 19 tabs.

35641 Low severity co-processing using homogeneous basic nitrogen promotors. Miller, R.L. (Chemical Engineering and Petroleum Refining Dept., Colorado School of Mines, Golden, CO (US)); Giacomelli, G.F.; Baldwin, R.M. *American Chemical Society, Division of Gas and Fuel Chemistry, Preprints (USA),* 33(1): 154-162 (Jun 1988). (CONF-8806136–: American Chemical Society Division of Fuel Chemistry meeting, Toronto, Canada, 5-10 Jun 1988).

In searching for effective coal dissolution promotors to be evaluated at low severity co-processing conditions, the authors concluded that, based on results from high severity studies, basic nitrogen compounds warranted extensive study. A previous study summarized data from several high severity liquefaction studies using 1,2,3,4-tetrahydroquinoline (THQ) in which THF coal conversions in the range of 85-100 wt% (MAF basis) were obtained with Wyodak subbituminous coal and Illinois 6 bituminous coal at reaction temperatures of 400^0-450^0C. However, distillate yields from these experiments were much lower than expected, and nitrogen material balance measurements indicated significant adduction of the THQ into non-distillable products. Thus, while basic nitrogen compounds appear attractive as coal dissolution promotors, the adduction problem limits their usefulness in high severity co-processing. The authors hypothesized that utilizing basic nitrogen compounds at lower severity would reduce adduction sharply, but that effectiveness towards promoting coal dissolution would remain high.

0205 Products and By-products

Refer also to citation(s) 35640, 36239, 36444, 36445, 36446

35642 (AD-A–205006/0/XAB) **Jet-fuel deoxygenation. Interim report, March 1987-July 1988.** Darrah, S. Geo-Centers, Inc., Newton Upper Falls, MA (USA). Oct 1988. 29p. (GC-TR–88-1416-013). Available from NTIS, PC A03/MF A01.

This program was initiated to identify and characterize methods of deoxygenating quantities of jet fuel to improve fuel thermal stability. Three methods - chemical getters, molecular sieves and nitrogen sparging - were evaluated. In the case of nitrogen sparging, additional results were obtained by comparing laboratory experimental results with the output from ULLAGE, a computer-based mathematical model. Each method was shown to reduce the oxygen content of jet fuel. Economic and system considerations favor nitrogen sparging for large quantities of fuel. Jet fuels, Deoxygenation. (mjm)

35643 (DOE/PC/88827–T2) **Thermal stability of jet fuel: Second quarterly report, January–March 1989.** Eser, Semih; Perison, J.; Copenhaver, R.M.; Schobert, H.H. Pennsylvania State Univ., University Park, PA (USA). Coll. of Earth and Mineral Sciences. 1989. 71p. Sponsored by DOE Fossil Energy. DOE Contract AC22-88PC88827. Order Number DE89013516/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Six model compounds have been heat treated in nitrogen and air atmospheres at temperatures between 250 and 450°C for 1–4 hours. The treatments were carried out in microautoclave reactors according to the procedure outlined in the previous reports. The thermal treatments in air were carried out under 100 psig cold air pressure at 350 and 400°C. Some observations on the appearance of the reaction products are described. The reaction products from the thermal treatments in nitrogen have been analyzed by NMR and GC-MS. The results of these analyses are discussed. The NMR analysis of the reaction products from the treatments in air will be presented in the next report. 11 figs., 6 tabs.

35644 Reverse micelles in supercritical fluid chromatography. Smith, R.D. (Chemical Methods and Separations Group, Chemical Sciences Dept., Pacific Northwest Lab., Richland, WA (US)); Jones, H.K.; Wright, B.W.; Fulton, J.L. v.v of 1988 Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy (abstracts). Pittsburgh Conference, Pittsburgh, PA (1988). (CONF-880204–: 39. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, New Orleans, LA, USA, 22-26 Feb 1988).

Technical Paper NO. 628.

Reverse micelles and microemulsions in supercritical fluid solvents have recently been demonstrated and constitute potentially important new mobile phases for supercritical fluid chromatography (SFC). Reverse micelle mobile phases generally consist of a nonpolar continuous phase, an amphilphilic surfactant (such as AOT), and water, which occupies the core of the reverse micelle. Reverse micelles in supercritical fluids may be used to replace more polar mobile phases for normal-phase chromatography. Supercritical propane reverse micelle mobile phases have been investigated with silica columns and capillary columns and compared with liquid phases at ambient and elevated temperatures, and have been shown to greatly decrease retention for polar compounds. The decreased efficiency generally observed in liquid reverse micelle systems can be improved by operating at the higher supercritical temperature, where mass transport limitations are reduced. Use of a reverse micelle-supercritical fluid mobile phase further increases efficiency over reverse micelle liquid mobile phases due to the high fluid diffusivities. The separation of hydrophillic compounds, normally intractable by SFC, has been obtained. The general characteristics and phase behavior of supercritical fluid reverse micelle systems will be described. The potential applications and limitations of these mobile phases in SFC are also discussed.

0207 Marketing and Economics

Refer also to citation(s) 36256

35645 (AOSTRA–8808, pp. 14) **Comparative economic analysis of heavy oil recovery projects in China and Canada.** Qi, J. (RIPED, Beijing, People's Republic of China); Werth, F.J. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

China and Canada have great differences in petroleum fiscal systems. The effects of those fiscal systems and oil prices on the economics of heavy oil recovery projects are investigated. The paper also presents the economic evaluation results for a steam injection project taken from Karamay oilfield, China. Two economic indicators of supply oil price and marginal oil price are evaluated under both different petroleum fiscal systems. The heavy oil recovery projects are associated with high capital and operating costs. The economic characteristics of the different steam injection strategies are also studied. Finally, discussions have been made on the prospect of a heavy oil on-site upgrading project and the ways to improve the economics of a heavy oil recovery project. 4 refs., 8 figs., 7 tabs.

35646 (AOSTRA–8808, pp. 10) **Update: Refiners' and marketers' perspectives. What the crash of 1986 did to heavy crude economics and marketing.** Lundberg, T. (Energy Detente, North Hollywood, CA, USA). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The rise and fall of the light-heavy crude price differential is examined in light of refining and marketing developments that took place prior to, during, and after the world oil price crash of 1986. Rapid swings in supplies, prices, netbacks, and margins threw refining

economics into disarray. This seriously interfered with the planning process. Increased refined product trade, delayed heavy bottoms conversions investments, downstream joint ventures, and light products quality requirements robbed heavy crude and tar sands of developmental impetus. Environmental protection compliance stands as a potentially serious roadblock to use of heavy crude and non-conventional feedstocks. Political consequences of 1986 did their own damage to development prospects of heavy crude, by championing such longer-term goals as non-petroleum alternatives while all but ignoring the nearer-term feasibilities of heavy crude and tar sands. The shakeout among higher- vs lower-technology refineries with respect to heavy oil conversion has been interrupted, but if conventional crude supplies tighten and heavy crude economics improve, that shakeout will return with a vengeance. The first two oil price shocks in the 1970's provided incentives for heavier crudes and non-conventional petroleum. The third oil price shock in 1986 marked the contemporary market environment wherein the competitiveness of heavy crude and non-conventionals has faded. The disincentive to market and refine heavy crude was provided by lower crude oil prices and weak demand. Despite obvious benefits to consumers and the economy in general, this situation threatens the future ability of the energy industry to make a smooth transition to heavy and synthetic crudes dependency. 10 figs. 1 tab.

35647 (CHOA–8812) **Heavy oil. Markets in the 90's. How do they look?.** Canadian Heavy Oil Association (Canada). 1988. V (CONF-8811188–: International symposium on mine planning and equipment selection, Calgary, Canada, 3-4 Nov 1988;CE–02646). Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

This document includes the presentations made at a conference, covering heavy oil supply and demand in Canada to 2000; traditional and non-traditional markets; the need for upgrading; and the role of the provincial and federal governments in the development of heavy oil. Separate abstracts have been prepared for six papers from this conference.

35648 (DOE/EIA–0035(89/03)) **Monthly energy review, March 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 26 Jun 1989. 149p. Sponsored by DOE Management & Administration. Order Number DE89014154/JAW. Available from NTIS, PC A08/MF A01 - GPO - OSTI; GPO Dep.

US refiners' cost of crude oil rose to $16.55 per barrel in the first quarter of 1989, up 7 percent from the cost in the first quarter of 1988. Some of the crude oil price increase was passed through to consumers of petroleum products. For example, the average price of finished motor gasoline (excluding taxes) increased 6 percent. US petroleum productions did not reflect the crude oil price increase. It declined by nearly 6 percent in the first quarter of 1989 compared with the first quarter of 1988 and contributed to a 0.4-percent decline in total energy production. US consumption of all forms of energy combined remained near 22 quadrillion Btu, about the same as 1 year earlier. At the same time, real gross national product (GNP) in the first quarter of 1989 was up 3.1 percent compared with GNP in the first quarter of 1988. The widening gap between US energy production and US energy net imports. Energy net imports totaled 3.5 quadrillion Btu in the first quarter of 1989, up 5 percent from the level in the first quarter of 1988. Petroleum, which accounts for most of the US energy trade in terms of quantity and value, registered an 11-percent increase in net imports.

35649 (DOE/EIA–0109(89/03)) **Petroleum supply monthly, March 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 24 May 1989. 133p. Sponsored by DOE Management & Administration. Order Number DE89012962/JAW. Available from NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.

The Petroleum Supply Monthly (PSM) is one of a family of three publications produced by the Petroleum Supply Division within the Energy Information Administration (EIA) reflecting different levels of data timeliness and completeness. Data presented in the PSM describe the supply and disposition of petroleum products in the United States and major US geographic regions. The data series describe production, imports and exports, inter-Petroleum Administration for Defense (PAD) District movements, and inventories by the primary suppliers of petroleum products in the United States (50 States and the District of Columbia). The reporting universe includes those petroleum sectors in "Primary Supply." Included are: petroleum refiners, motor gasoline blenders, operators of natural gas processing plants and fractionators, inter-PAD transporters, importers, and major inventory holders of petroleum products and crude oil. When aggregated, the data reported by these sectors approximately represent the consumption of petroleum products in the United States. Data presented in the PSM are divided into two sections (1) the Summary Statistics and (2) the Detailed Statistics.

35650 (DOE/EIA–0109(89/04)) **Petroleum supply monthly, April 1989: Final 1988 statistics in summary section.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 29 Jun 1989. 125p. Sponsored by DOE Management & Administration. Order Number DE89014156/JAW. Available from NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.

The Petroleum Supply Monthly (PSM) is one of a family of three publications produced by the Petroleum Supply Division within the Energy Information Administration (EIA) reflecting different levels of data timeliness and completeness. The other two publications are the Weekly Petroleum Status Report (WPSR) and the Petroleum Supply Annual (PSA). Data presented in the PSM describe the supply and disposition of petroleum products in the United States and major US geographic regions. The data series describe production, imports and exports, inter-Petroleum Administration for Defense (PAD) District movements, and inventories by the primary suppliers of petroleum products in the United States (50 States and the District of Columbia). The reporting universe includes those petroleum sectors in "Primary Supply." Included are: petroleum refiners, motor gasoline blenders, operators of natural gas processing plants and fractionators, inter-PAD transporters, importers, and major inventory holders of petroleum products and crude oil. When aggregated, the data reported by these sectors approximately represent the consumption of petroleum products in the United states.

35651 (DOE/EIA–0340(88)/1) **Petroleum supply annual 1988: Volume 1.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 18 May 1989. 148p. Sponsored by DOE Management & Administration. Order Number DE89014826/JAW. Available from NTIS, PC A08/MF A01 - GPO - OSTI; GPO Dep.

The Petroleum Supply Annual (PSA) contains information on the supply and disposition of crude oil and petroleum products. The publication reflects data that were collected from the petroleum industry during 1988 through annual and monthly surveys. The PSA is divided into two volumes. This first volume contains two sections, Petroleum Supply Summary and Refinery Capacity, each with final annual data. The second volume contains final statistics for each month of 1988, and replaces data previously published in the Petroleum Supply Monthly (PSM). The tables in Volumes 1 and 2 are similarly numbered to facilitate comparison between them. 40 tabs.

35652 (DOE/EIA–0517(89)) **Annual outlook for oil and gas 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 1 Jun 1989. 97p. Sponsored by DOE Management & Administration. NONE. Order Number DE89013169/JAW. Available from NTIS, PC A06/MF A01 - GPO - OSTI; GPO Dep.

Since 1973, the US petroleum and natural gas industry has been affected by a number of dramatic events that have changed the way the oil and gas markets operate and, consequently, the long-term outlook for them. The Annual Outlook for Oil and Gas 1989 (AOOG89) discusses recent events affecting these markets and the likely impacts of these events on the future. Forecasts for petroleum and natural gas markets are presented in this report through the year for a base case and two alternative cases. These cases combine lower world oil prices with higher economic growth and higher world oil prices with lower growth. The base case assumption for world oil prices in the year 2000 is $28.00, in 1988 dollars. The two alternative world oil price cases assume world oil prices in the year 2000 that range from $21.70 to $35.00. In the base case, the

economic growth, measured by the Gross National Product, is assumed to grow at an annual rate of approximately 2.5 percent. With the low and high growth assumptions, the economy grows at annual rates of 2.2 and 2.8 percent, respectively. An additional case describes that impact of an alternative scenario that increases the natural gas import assumptions. 16 figs., 19 tabs.

35653 (DOE/EIA–0520(89/06)) **International petroleum statistics report.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 26 Jun 1989. 36p. Sponsored by DOE Management & Administration. Order Number DE89014810/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The International Petroleum Statistics Report presents data on international oil production, consumption, imports, exports, and stocks. The report has three sections. Section 1 contains time series on world oil production, and on oil consumption and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1973, and monthly data for the most recent two years. Section 2 presents an oil supply/consumption balance for the market economies (i.e. non- communist countries). This balance is presented in quarterly intervals for the most recent two years. Section 3 presents data on oil imports by OECD countries. This section contains annual data beginning in 1982, and quarterly data for the most recent two years. 23 tabs.

35654 (DOE/RL/01830–H3) **Oil use and oil dependency: Long-term issues.** Serot, D.E.; Belzer, D.B.; Guthrie, S.A.; Roop, J.M. Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 156p. Sponsored by DOE Management & Administration. DOE Contract AC06-76RL01830. Order Number DE89014614/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The continued dependence of the United States on imported oil is a matter of increasing concern. Under the direction of the Department of Energy's Office of Policy Integration, Pacific Northwest Laboratory conducted a study which was to examine long-term issues related to oil dependence. Major issues addressed are (1) energy efficiency and the role of new technologies, (2) fuel switching, and (3) regional factors affecting fuel use. The study examines all major end-use sectors in the economy, covering the industrial, commercial, residential, transportation, and electric utility sectors. The potential impacts of efficiency improvements in oil- using equipment are assessed through the year 2000. 107 refs., 8 figs., 9 tabs.

35655 (MU–8708) **Final report of the Commission of Inquiry into Gasoline Pricing in the province of Manitoba, 1987.** Nicolaou, C.A. Manitoba Univ., Winnipeg, MB (Canada). 1987. 309p. (MICROLOG–89-00831). Available from Manitoba. Dept. of Consumer and Corporate Affairs, Legislative Bldg., Rm. 104, Winnipeg, MB, Canada R3C 0V8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A commission was established to investigate Manitoba retail gasoline prices and their responsiveness to crude oil costs, as well as upon matters pertaining to the regulatory powers of the province in relation to gasoline and related products. Data were obtained from a number of sources including surveys, literature reviews, and contacts with industry and government. This report presents the results of the commission's investigations and includes a description of the structure of the Canadian petroleum industry and the wholesale and retail gasoline markets. The main findings and recommendations are as follows. Gasoline prices in Winnipeg have not fully reflected reductions in crude oil costs in 1986. This situation is estimated to have cost the average motorist $35-50/y and these losses are just one example of the lack of effective competition. The need to improve the Manitoba market in terms of local market conditions is therefore indicated. Wholesale gasoline prices to large independent resellers have been fairly competitive for some time, but there is a need for these wholesale prices to be made available to smaller resellers and other users. To achieve this result, it is recommended that an agency be hired or created to buy gasoline from existing competitive sources and to resell it at a single competitive price to any reseller, farmer, or commercial/industrial user. To keep retail margins competitive, it is also recommended that the government set up a small number of Winnipeg gasoline stations and lease them to independent resellers willing to resell gasoline at a competitive retail margin. 50 figs., 20 tabs.

35656 (NEI-NO–85) **Cost effectiveness.** Norsk Petroleumsforening, Oslo. 1988. 127p. (CONF-8805291–: Offshore Northern Seas '88, Stavanger, Norway, 23-26 May 1988). Order Number DE89776211/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

This section of the proceedings contains seven papers covering the following topics: Cost consideration factors; Effect of regulations on cost; An integrated approach to cost consciousness; Project management and execution; How to make smaller fields viable; Developing cost effective technology for the future; Cost effective operation. Separate abstracts were prepared for two papers of the section.

0208 Waste Management

35657 (AL–86-ALL-07(A-80)) **Beaufort Sea ocean dumpsite characterization.** Arctic Labs. Ltd., Sidney, BC (Canada); LGL Ltd. Environmental Research Associates, King City, ON (Canada). 1987. 247p. (MICROLOG–88-06210). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The seabed at two potential Beaufort Sea sites for dumping solid wastes from the oil and gas industry was characterized in late August 1986 by side-scan sonar coverage, bathymetry, sub-bottom profiling, surficial sediment particle size, surficial sediment trace metal and hydrocarbon content, and infaunal benthic community species and density. Sampling was conducted during a one week cruise aboard a research ship. In addition, within each dumpsite, trawls were jarried jout to qualitatively sample for epibenthos and bottom fish. At each location, two grab samples were taken with a Smith-McIntyre grab (0.1 m^2 surface area bite). One was sieved for macrobenthos, the second sub-sampled for trace metals, hydrocarbon, and particle size analyses. 30 locations were sampled in and around each dumpsite. Sample locations were chosen randomly; 10 sites were within 1.5 km radius of the dumpsite center; 20 sites between 1.5 and 3.0 km. 22 refs., 32 figs., 39 tabs.

35658 (EPS–CP(EP)-2) **Recommendations on a preferred site for the ocean disposal of bulky inert materials in Beaufort Sea waters adjacent to the Northwest Territories.** Environnement Canada, Ottawa, ON (Canada). Conservation et Protection. 1987. 30p. (MICROLOG–88-06214). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Industrial operators in the Beaufort Sea region have noted a requirement to dispose of inert waste materials generated by hydrocarbon exploration or production activities. An assessment process was initiated in order to examine the option of marine disposal of these wastes at an appropriate site. The ultimate goal of this process is to select a preferred dumpsite that would meet certain specified criteria. This report provides an overview of all factors considered during the ocean dumpsite selection process and a rationale for the location selected as an offshore waste disposal site. It also summarizes the types and quantities of inert materials to be dumped, the physical and oceanographic characteristics of the potential dumpsite, and the environmental effects of ocean dumping. The recommended dumpsite is located near the upper edge of the continental slope at depths sufficient to allow unrestricted surface vessel travel. Wind and near-bottom current data are not currently available for the specific ocean dumpsite, but existing bottom current measurements indicate that mean velocities range between 7.4 and 10.8 cm/s and maximum velocities reach between 22.6 and 40.9 cm/s in the general vicinity of the recommended site. These maximum currents are not expected to be strong enough to remobilize bulky materials, although uncrushed steel drums could be rolled. Environmental effects are expected to be localized and short-lived, although some activities associated with ocean dumping could

elicit an avoidance response among bowhead and white whales. 21 refs., 7 figs., 4 tabs.

35659 (EPS–CP(EP)-3) **Selection of an area in the Canadian Beaufort Sea for disposal of inert bulky materials such as scrap metal. An assessment of options.** Environnement Canada, Ottawa, ON (Canada). Conservation et Protection. 1986. 68p. (MICROLOG–88-06215). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The purpose of this project was to assess the constraints that might affect the designation of a bulky inert waste ocean disposal site in the Canadian Beaufort Sea, and to recommend one or more preferred dumpsite locations. The possible ocean dumping needs of northern business and alternate modes of waste transport were examined. A decision matrix was used to determine the degree of acceptability for dumpsite selection of areas of the Beaufort Sea. The screening of areas was based on a review of the nature, quantities, and sources of wastes to be dumped, the factors affecting dumpsite selection (including biotic populations, pertinent climatological, oceanographic, and ecological features, government legislation and policies, oil and gas development, shipping, and other uses of the sea) and the effects of ocean disposal of bulky inert wastes. For wastes stockpiled at Tuktoyaktuk, the closest acceptable ocean disposal areas would be located approximately 160 km away. The cost per trip to the acceptable areas is estimated at $43,000. The closest acceptable disposal area from King Point (Yukon) is located 50 km to the north northeast. Several other acceptable and potentially acceptable areas are located within 170 km of King Point. Depending on which area is selected, the round-trip costs would range from about $28,000 to $45,000. It is recommended that dumping take place from a barge or oilfield supply vessel during the open-water season. The material should be carefully released from a stationary vessel to minimize the zone of impact, and all subsequent loads should be dumped to the side to ensure that the material does not pile up and create a navigational hazard. 55 refs., 8 figs., 2 tabs.

35660 (HBBT–ESRF093) **Handling and disposal of waste drilling fluids from on-land sumps in the Northwest Territories and Yukon.** Schilder, V.; Soniassy, R. Hardy BBT Ltd., Edmonton, AB (Canada); Stanley Associates Engineering Ltd., Edmonton, AB (Canada). 1988. 66p. (MICROLOG–89-00752). Available from Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, ON, Canada K1A 0E4; $17.50 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This publication is a consolidation of two reports on the disposal of waste drilling fluids from on-land wells in northern Canada. The general objectives of the reports were to examine current practice, to consider future drilling needs and to recommend: improvements in methods of disposing of waste fluids; the suitability of methods for different well types and locations; and the regulation of disposal. The report data were obtained from a literature review, interviews and a workshop. Current practice in the North is to attempt total containment by disposing of fluids in a sump which is then backfilled. Decanting is rarely planned, although it has been used on an emergency basis when sumps are overfilled. Direct on-land disposal has been attempted once as an experiment. There are three reasons for concern about the disposal of drilling fluids. The first is their toxicity to living organisms and the second the potential for terrain damage that may accompany sump construction or disposal on to the ground surface, especially where permafrost is present. The practice of total containment for the disposal of drilling fluids in the North is generally endorsed. However, it is recommended that definition be made of conditions under which partial or non-containment, including emergency decanting, might be used. Also recommended is the development and adoption of a toxicity test that can be applied quickly to fluids awaiting disposal during a drilling operation. In addition, detailed recommendations are presented which are intended to improve regulatory practices and to reduce or avoid practical problems encountered in disposing of drilling fluids. 47 refs.

0209 Environmental Aspects

Refer also to citation(s) 37207, 37234

35661 (ESL–ESRF089) **Distribution, abundance and age segregation of bowhead whales in the southeast Beaufort Sea, August-September 1986.** Ford, J.K.B.; Cubbage, J.C.; Norton, P. ESL Environmental Sciences Ltd., Vancouver, BC (Canada); Cascadia Research Collective, Olympia, WA (USA); PN Research Projects, Sydney, BC (Canada). 1987. 103p. (MICROLOG–89-00754). Available from Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, ON, Canada K1A 0E4; $19.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Aerial systematic and photogrammetric surveys were conducted in the southeast Beaufort Sea during August and September 1986, to investigate the distribution, relative abundance, and age segregation of bowhead whales in relation to petroleum industry activities in the region. The distribution and abundance of bowheads was similar during both survey periods. Most whales were located in an area in Mackenzie Bay about 40-60 km offshore of Shingle Point, within a band 40-100 km offshore of the eastern Tuktoyaktuk Peninsula, and near the Yukon coast and Herschel Island. Bowhads have been observed to congregate in each of these regions during some of the previous years of systematic surveys. It is likely that large-scale oceanographic phenomena lead to high densities of zooplankton in each of these areas during some years, and whales seen in these areas of concetration during 1986 appeared to be feeding. A total of 109 bowheads were as measured in the photogrammetric component of the study. As found in earlier studies the population was geographically segregated by age. In 1986, there was considerably less industry activity in the study area than in recent years, yet whales were still uncommon in the industrial zone. This suggests that the distribution of whales was determined by other factors, likely those influencing the distribution and abundance of their prey. However, mature whales were again under-represented in the photogrammetric sample, and the remaining portion of this component of the population was probably located outside the study area. Available evidence suggests that the distribution of bowheads in the southeast Beaufort Sea is naturally segregated by age class. 47 refs., 18 figs., 18 tabs.

35662 (STF–21A87099) **Oil at shore and in deposits. Successive report 1987.** Sveum, P.; Danielsen, A.; Klokk, T. Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway). Dec 1987. 25p. (In Norwegian). Order Number DE89776218/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Two deposits of oil containing mass have been inspected, the Brattholmen in Troms and the Tenna at Helgeland. Degradation aspects are studied. Both deposits have anaerobic conditions and hydrocarbons are slowly degraded. The Tenna leaks oil. Principles for treating oil contaminated wastes in biologically active deposits are discussed, with process simplification in mind. Degradation rate is low and connected to the degradation. The time perspective is 9-10 years. The results are concequently not final. The oil contaminated mass stranded at the Utoey island following the wrecking of Deifovos, was degraded to a satisfactory level during 3-4 years. The mass had a low oil content. It is important to distinguish between depositing and composting. The latter method can lead to quite high degradation rates by mechanically keeping oxygen supply at an acceptable level. Three shores polluted by oil spills some years ago are visited, the Bratholmen and the Kiloey islands which were polluted in 1980 by the Deifovos wreck, and a shore at Agdenes experimentally polluted in 1983. The latter shore is restored from a botanic view-point. Areas treated with manure are restored quicker than untreated shores. The Brattholmen shore has still considerable oil quantities caracterized as asphalt. The macrofauna, and to some extent the microfauna, is considerably restored. Macroalgae are however, colonizing more slowly than expected. The Kiloey shore is "clean" in the eulittoral zone and the macrofauna is mostly restored. The macroalgae have colonized the shore to a larger extent than at the Brattholmen. The vegetation is well developed in the supralittoral zone although asphalt is present in the soil and cracks. 7 drawings, 2 tabs.

0210 Legislation and Regulation

Refer also to citation(s) 35647

0230 Properties

Refer also to citation(s) 35642, 37132

35663 (AOSTRA–8808, pp. 20) **Improved techniques for measuring heavy crude oil vapor pressures for monitoring tank emissions.** Burke, N.E.; Chea, C.K. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Current methods for calculating crude oil storage tank emissions involve knowledge of the vapor pressure of the stored crude and the molecular weight of the emitted vapor. Techniques now used to measure the vapor pressures of hydrocarbon mixtures do not yield accurate results for heavy crudes. This paper describes a technique for measuring the vapor pressure of heavy crudes using headspace gas chromatography, (HGC). This method provides the composition and molecular weight of the emitted vapor. A major advantage of HGC is its ability to determine the vapor pressure exerted by the polluting hydrocarbons alone and ignore the vapor pressure contributions from water or non-reactive hydrocarbons. With the instrumentation used, HGC is reproducible and can be easily automated for routine testing. The accuracy of the HGC method has been verified through vapor pressure measurements performed on n-haxane. To provide a theoretical basis for comparison, the results from the HGC techniqe have also been compared with vapor pressure data obtained on heavy crudes by pressure-volume-temperature (PVT) measurements and equation of state simulations. Results indicate that the headspace method is accurate and that it is more sensitive and requires less sample than either PVT methods or conventional techniques. 7 refs., 8 figs., 10 tabs.

35664 (NIPER–403) **Thermodynamic equilibria in the biphenyl/hydrogen system (The power and limitations of group additivity estimations): Topical report.** Steele, W.V.; Chirico, R.D. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). Jul 1989. 25p. Sponsored by DOE Fossil Energy. DOE Contract FC22-83FE60149;FG02-87ER13785. Order Number DE89000754/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Calculated equilibria in the biphenyl/phenylcyclohexane/bicyclohexane/hydrogen system are presented and compared with experimental values reported in the literature. Gibbs energies of formation were estimated for phenylcyclohexane and bicyclohexane using group-additivities. The results were combined with values for biphenyl obtained from experimental thermodynamics to calculate the equilibria in the system. Under thermodynamic equilibrium conditions the maximum concentration of phenylcyclohexane obtainable is approximately 60 mole per cent. As the temperature is increased this maximum concentration can only be obtained by a corresponding increase in hydrogen pressure. In a given temperature regime, too high a hydrogen pressure will facilitate the formation of the fully saturated compound, bicyclohexane, and too low a hydrogen pressure the formation of biphenyl. Equilibrium conditions for the generation of hydroaromatics have been defined. Hydrogen transfer from a donor molecule (here tetralin) to an aromatic acceptor (here biphenyl) is favored by low temperature and a large excess of the donor over the acceptor. The report concludes that an order of magnitude improvement in the additivity methodology (increase in the accuracy and precision of the group-contribution term parameters) is required to enable meaningful calculation of the conditions under which thermodynamic equilibria exist in the hydrogenation of multi-ring aromatic systems. 27 refs., 6 figs., 6 tabs.

35665 (NRCC/IMR–29092) **Laboratory investigation on the evaluation of crude oil concentration by spectroscopic methods.** Cielo, P.; Cole, K. National Research Council of Canada, Boucherville, PQ (Canada). Industrial Materials Research Inst. 1988. 21p. (MICROLOG–89-00542). Available from Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A Fourier transform infrared transmission spectroscopy approach for oil-in-water concentration monitoring was investigated. Transmission spectra of crude oil and water samples of typically 1 mm thickness were taken, using cells with windows of either potassium bromide or barium fluoride. A near-infrared spectrum was chosen for this application for a number of reasons, including a lower absorptivity which facilitates the possibility of obtaining a suitable absorptivity signal with a conveniently large cell thickness. The ability of the spectroscopic method to differentiate the spectral absorption bands of the oil and water is discussed. Possible problems in taking spectral measurements are mentioned, including attenuation by scattering from oil-water interfaces in an emulsion, and the possible variations in spectral characteristics for different kinds of crude oil. The possibility of extending such spectral measurements to an in-situ device for direct use in oil wells is also discussed. 3 refs., 6 figs.

0250 Combustion

35666 (AD-A–205281/9/XAB) **Laboratory evaluation of MIL-T-83133 JP-8 fuel in army diesel engines. Interim report, October 1984-January 1988.** Likos, W.E.; Owens, E.C.; Lestz, S.J. Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility. Jan 1988. 278p. (BFLRF–232). Available from NTIS, PC A13/MF A01.

To support the need to upgrade aviation turbine fuel JP-8 from 'emergency' to 'alternate' status for diesel-powered equipment and to further advance its use as a single-fuel concept, four Army diesel engines were evaluated by dynamometer tests in cyclic endurance test procedures using JP-8 fuel and compared to baseline performance using diesel fuel (DF-2). Results showed the advantages for JP-8 fuel to include: Increased engine efficiency at the maximum power conditions, Lower rate of cylinder combustion chamber deposit formation, Less contamination of the engine lubricant, Less wear of the upper ring area, Lower rate of depletion of the lubricant additives, Less corrosive wear of the engine bearings, and Fewer deposits on the fuel injectors. JP-8 was found to be satisfactory for use in all engines tested. Abnormal wear occurred in the fuel injection pump of the GM 6.2L engine while operating on JP-8 during an engine dynamometer test. This wear resulted in higher fuel-delivery rates and erratic injection timing. Later field tests did not show such wear problems. the use of JP-8 in the diesel-engine powered vehicles holds some advantages, notably for the engine and oil durability for most engines tested. The disadvantages include reduced vehicle range and reduced maximum power.

03 NATURAL GAS

Refer also to citation(s) 36365

35667 (DOE/FE–0134) **Unconventional gas recovery program plan, FY 1989.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of the Deputy Assistant Secretary for Oil, Gas, Shale and Special Technologies. Jun 1989. 32p. Sponsored by DOE Fossil Energy. Order Number DE89013911/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The ability to convert natural gas cheaply and efficiently into a transportable fuel such as gasoline would not only open new markets for presently "usable" gas but would greatly contribute to reduction of petroleum imports to the United States. Achievement of this desirable use for natural gas is contingent on the availability of a conversion process which produces a high yield of a transportable liquid fuel which has favorable energy density, combustion, and environmental characteristics. DOE's specific technical objectives for the Unconventional Gas Recovery (UGR) program are presented. 11 refs., 4 figs., 2 tabs.

35668 (PB–89-173686/XAB) **GRI (Gas Research Institute) catalog of technical reports.** Cramer, T.L. Gas Research Inst.,

Chicago, IL (USA). Jan 1989. 112p. (GRI–89/0068). Available from NTIS, PC A06/MF A01.

Gas Research Institute (GRI) plans, manages, and develops financing for a cooperative research and development program in gaseous fuels and their use. The catalog provides a cumulative listing of all contractor R&D reports issued by GRI since its establishment that are available from the National Technical Information Service (NTIS). Abstracts are provided for those reports that have become available from NTIS since the last catalog (September 1985). Indexes by subject, contractor, contract number, GRI report number, and NTIS order number are included, as are instructions for ordering reports from NTIS.

35669 (PB–89-177802/XAB) **Technology 'Master List' data base management system. User's manual. Topical report.** Rimpo, J.Y.; Owens, M.J. Economic Systems Analysis, Inc., Oak Ridge, TN (USA). Sep 1988. 111p. Available from NTIS, PC A06/MF A01.

In order to track the movement of Gas Research Institute (GRI) projects from the drawing-board concept to commercialized product, GRI developed a 'Master List' of these technologies and research applications. An interactive data base management program (titled 'WIN') was developed to permit manipulation and updating of the 'Master List' data base. The user's manual provides information on using this data base management program, including record management (adding, editing, deleting, and moving records), report generation (selecting, sorting, and printing), and data base maintenance. The system is designed to be used with the dBase III Plus software on IBM or compatible personal computers.

0301 Reserves

Refer also to citation(s) 35601

35670 (DOE/MC/24219–2705) **Characterization and utilization of natural gas in Alaska: Final report.** Sharma, G.D. Alaska Univ., Fairbanks, AK (USA). Mar 1989. 70p. Sponsored by DOE Fossil Energy. DOE Contract FG21-87MC24219. Order Number DE89000992/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The natural gas in the Alaskan arctic represents a truly significant resource; a resource which should be exploited in the most appropriate manner. Currently, the proven reserves of natural gas in Alaska are estimated to be 19.7% (36.7 TSCF) of the total US reserves (186.7 TSCF). In addition, the undiscovered recoverable natural gas resources of Alaska are about 89 TSCF compared to 610 TSCF in the lower 48 states. Furthermore, the Alaskan unconventional gas resources are more than 500 TCF. The purpose is to review the potential of natural gas resources in Alaska and to address various important issues related to utilization of natural gas. This report provides a brief summary of various gas fields and their geologic settings. The different options for utilization of natural gas to lower 48 states via gas pipeline, conversion to liquefied natural gas and transport, conversion to fuel grade methanol and/or gasoline, natural gas for enhanced oil recovery, gas based petrochemical complex, gas utilization in the form of utilities are critically reviewed with respect to merits and demerits addressing engineering, economic, environmental, supply/demand, market and political aspects. 22 refs., 2 figs., 5 tabs.

0302 Geology and Exploration

Refer also to citation(s) 35601

35671 (PB–89-173207/XAB) **Documentation and review of Eastern Gas Shales Technology. Annual report, April 1, 1984-March 31, 1985.** Skrinak, V.M. BDM Corp., McLean, VA (USA). Jun 1985. 82p. Available from NTIS, PC A05/MF A01.

See also PB–88-181276.

The Eastern Devonian Gas Shales Technology Review is a technology transfer vehicle designed to keep industry and research organizations aware of major happenings in the shales. Four issues were published, and the majority of the readership was found to be operators. Under the other major task in this project, areal and analytic analyses of the basin resulted in reducing the study area by 30% while defining a rectangular coordinate system for the basin. Shale-well cost and economic models were developed and validated, and a simplified flow model was prepared.

35672 (PB–89-178743/XAB) **Site selection for GRI (Gas Research Institute) cooperative tight-gas field research. Volume 1: screening of candidate tight gas formations. Topical report, May-July 1988.** Haas, M.R.; McFall, K.S. ICF-Lewin Energy, Fairfax, VA (USA). Dec 1988. 217p. Available from NTIS, PC A10/MF A01.

See also PB–89-146302.

Geologic and engineering data for selected low-permeability gas formations were compiled to provide a basis for selecting potential sites for the Gas Research Institute's (GRI) fourth Staged Field Experiment (SFE) and cooperative wells with industry. Increasingly detailed screening criteria were applied to 189 documented tight-gas settings to designate twelve candidate formations for GRI field research. Technical selection criteria were established to ensure that resulting field research addressed the resource potential of a formation, recognized scientific challenges to be overcome, and maximized opportunities for technology transfer. Four formations are in the Rocky Mountains, two in the Appalachian Basin, two in the Denver Basin, and one each in the San Juan, Permian, Anadarko, and Texas Gulf Coast basins. The formations represent a range of current development and technical challenges. Four of the twelve formations were identified as having highest potential: the Abo, Corcoran-Cozzette/Mesaverde, Frontier, and Cleveland. More detailed characterization of these four priority formations appears in Volume II of the report.

35673 Characterization and implications of dickite-mineralized fractures in Mesaverde core from Piceance Creek basin. Finley, S.J. (Sandia National Labs., Albuquerque, NM (USA)); Lorenz, J.C. *AAPG (American Association of Petroleum Geologists) Bulletin (USA),* 73(3): 355 (Mar 1989). (CONF-890404–: AAPG annual convention with DPA/EMD Divisions and SEPM, San Antonio, TX, USA, 23-26 Apr 1989).

The presence of authigenic dickite, a polymorph of kaolinite, in fractures in the gas-productive Mesaverde Formation of the Piceance Creek basin may indicate a locally interconnected fracture system. Core used in this study is from the US Department of Energy's Multiwell Experiment located in the Rulison field in northwestern Colorado. The Mesaverde is fractured throughout the 4000-ft section cored at this location. Although spray calcite is the most common fracture mineralization throughout the section, dickite mineralization commonly occurs as a secondary phase in fractures within a roughly 400 ft-thick interval. The petrography of the host rock where these fractures are concentrated is similar to the petrography of other core intervals where dickite mineralization and/or irregular fractures were not detected. No apparent difference is seen in the mineral constituents or the diagenetic alteration of the minerals present, suggesting that the source of the dickite may have been extraformational. If the dickite is extraformational, the variation in the orientations of these anomalous dickite-mineralized fractures, coupled with the presence of dickite on some other types of fractures, implies that at some time in the depositional and burial history of the rock the dickite fractures represented an interconnected fracture system. Microporosity is associated with the dickite mineralization, and this fracture system may still be locally interconnected and permeable making this a potentially gas-productive interval. Special consideration of drilling and/or stimulation fluid interaction with dickite may be necessary.

0303 Drilling, Production, and Processing

Refer also to citation(s) 35634, 35670, 35671

35674 (DOE/EIA–0130(89/04)) **Natural gas monthly: April 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 26 Jun 1989. 147p. Sponsored by DOE Management & Administration. Order Number DE89014078/JAW. Available from NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.

The Natural Gas Monthly (NGM) is prepared in the Data Operations Branch of the Reserves and Natural Gas Division, Office of Oil

and Gas, Energy Information Administration (EIA), US Department of Energy (DOE). The NGM highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported. From time to time, the NGM features articles designed to assist readers in using and interpreting natural gas information. The data in this publication are collected on surveys conducted by the EIA to fulfill its responsibilities for gathering and reporting energy data. Some of the data are collected under the authority of the Federal Energy Regulatory Commission (FERC), an independent commission within the DOE, which has jurisdiction primarily in the regulation of electric utilities and the interstate natural gas industry.

35675 (PB–89-173595/XAB) **Stretford chemistry and analytical methods handbook. Topical report.** Andrews, E.M. Radian Corp., Austin, TX (USA). Feb 1989. 195p. (DCN–88-218-043-45). Available from NTIS, PC A09/MF A01.

GRI has developed a handbook on the chemistry and analytical methods for monitoring the Stretford process. The document presents information on process chemistry and laboratory guidelines, and sampling, preservation, and analytical methods. The first sections contain information about the process and its chemistry, and guidance on setting up and operating a Stretford analytical laboratory. A compilation of twenty analytical methods for monitoring the Stretford process including methods for sulfur species, ADA methods, vanadium methods, carbonate methods, complexing-agent methods, gas analysis, sulfur cake methods and miscellaneous-process measurements are listed in the second half of the handbook.

35676 (PB–89-181168/XAB) **Reservoir Engineering and Treatment Design Technology. Annual report, December 1987-November 1988.** Murtha, J.A.; Gatens, J.M.; Hopkins, C.; Lancaster, D.E.; Lane, H.S. Holditch (S.A.) and Associates, Inc., Bryan, TX (USA). Dec 1988. 169p. Available from NTIS, PC A08/MF A01.

See also PB–88-203211.

This report presents an overview of the Comprehensive Study Well (CSW) program along with status reports on five of the CSW's drilled to date in this second year of the 'Reservoir Engineering and Treatment Design Technology' program. The focus for 1988 was design, monitoring, and evaluation of fracture treatments. The activities include gathering and analyzing data from both pre- and post-stimulation well tests and from the stimulation treatments themselves. Results identified in the report include the evolution of a treatment design simple both in concept and execution but which should create a desirable highly conductive propped fracture; the identification of key problems remaining to be solved in design, execution, and cleanup; the continued progress in determining in-situ stress profiles from log-based measurements; and developments in the research with analytical models and gas desorption studies.

0306 Marketing and Economics

Refer also to citation(s) 35652, 35656, 35670, 35674, 36256, 36265, 36266, 36271, 36419

35677 (MPUB–7389) **Application by Greater Winnipeg Gas Company and ICG Utilities (Manitoba) Ltd. for an order or orders approving rates for the sale of natural gas from November 1, 1988 to October 31, 1990, flowing from new gas supply contracts.** Manitoba Public Utilities Board, Winnipeg, MB (Canada). 1989. 10p. (CE–02691). Available from Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, MB, Canada R3C 3L6; $N/C.

This report summarizes the decisions resulting from the application of the Greater Winnipeg Gas Company and the Inter-City Gas (Manitoba) Ltd. (the Companies') to the Public Utilities Board (the board) for rates arising from their new gas supply arrangements with Western Gas Marketing Limited and other matters. The arrangements provide for a firm long term supply of gas for the companies' entire requirements for the net 15 year period. The Board determined that its jurisdiction extends to the approving or otherwise the retail rates put forth by the Companies. The Board determined that the applied for rates, subject to certain adjustments for timing, are just and reasonable. The Board emphasized that it will assess the reasonableness of future rates beyond the initial 2 year period on the merits of the Companies' future applications. Any future financial risk associated with these contracts must be borne by the Companies and more specifically by the Companies' shareholders. 2 tabs.

35678 (OEB–32) **Gas supply. Reference from the Lieutenant Governor in Council.** Ontario Energy Board, Toronto, ON (Canada). 1988. V (MICROLOG–89-02266). Available from Publications Ontario, 880 Bay St., 5th Floor, Toronto, ON, Canada M7A 1N8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A public hearing was held by the Ontario Energy Board into matters pertaining to the current and future supplies of natural gas required to meet the needs of Ontario gas consumers. This report presents the views of the parties involved, and the recommendations of the Board, on principles of security of supply, short-term supply arrangements (backstopping, diversity), long-term supply arrangements (continental market/free trade, supply/demand balance, transportation capacity, market segmentation), security of supply (short-term, contract terms and conditions, market access and obligation to supply, relative price among groups, competition among suppliers and market access), arbitration provisions, and implementation.

0307 Waste Management

Refer also to citation(s) 35657, 35658, 35659, 35660

0309 Artificial Stimulation

Refer also to citation(s) 35676

35679 (AOSTRA–8808, pp. 8) **Unique completion practices in a horizontal well.** Wilkins, D.A. (Moore and Associates, Amarillo, TX, USA); Shursen, G.; Yost, A.B.; Overbey, W.K. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

This paper discusses some new and unique completion practices which were implemented in a horizontal well in the Devonian shale formation, Wayne County, West Virginia. The well was successufully completed and tested in 7 different intervals along the 2000 ft horizontal section without the aid of cementor perforating. External casing packers and port collars were utilized to isolate the intervals, each of which was opened and closed to the wellbore numerous times throughout the testing. Bottomhole assemblies were designed and used to test one or more intervals up a single string of tubing while monitoring one or more different intervals up the tubing-casing annulus. Selected intervals have been stimulated using a variety of treatment designs in efforts to optimize production. Specialized surface and downhole equipment were used to monitor pressures and production rates throughout the testing. The completion techniques used in this well are unique to the industry and have provided optimum test results with very little effort, risk, or cost. 1 ref., 3 figs., 3 tabs.

35680 (PB–89-178164/XAB) **Fracture-height growth containment using low-permeability bridging agents to stimulate tight gas sands with weak barriers. Topical report, January 1982-March 1985.** Kelkar, S.; Strawn, J.; Holland, M.; Owen, L.; Hansen, J. Terra Tek, Inc., Salt Lake City, UT (USA). Mar 1985. 144p. (TR–85-87). Available from NTIS, PC A07/MF A01.

This report evaluates the feasibility of using bridging agents to control fracture height growth in tight (low permeability) gas formations bounded by base rock and/or overlain by an overburden rock, which are not barriers to fracture migration. The bridging-agent technique is one of the four proposed modified hydraulic fracturing

techniques that attempts to improve gas production from tight formations by controlling fracture migration. Analytical models for determining fluid pressure profiles within the fracture, and for determining flotational velocities for the bridging agent slurry were also developed.

35681 (PB–89-181432/XAB) **Measurement of static coalbed-reservoir conditions for hydraulic-fracture design. Volume 2. Final report, March 1983-December 1986.** Boyer, C.M.; Briscoe, F.H.; Camp, B.S.; Dobscha, F.X.; Malone, P.G. USX Corp., Monroeville, PA (USA). USS Technical Center. Dec 1986. 787p. (REPT–76-H-088/089). Available from NTIS, PC A99/MF E04.

See also PB–88-118252. Portions of this document are not fully legible.

A single-zone coalbed methane well was completed into the Mary Lee and Blue Creek coal seams in the Warrior basin of Alabama to evaluate the geologic and reservoir parameters that affect the stimulation and production of coalbed methane. Following the successful drilling and coring of the well, reservoir testing resulted in a measured coal seam permeability of 1 millidarcy and a skin factor of -4 to +1. In-situ state-of-stress tests in the Blue Creek coal seam indicated a vertical primary closure and a secondary horizontal closure. Coal and rock-core tests resulted in reservoir and mechanical values consistent with well-test data and underground-fracture observation.

0310 Legislation and Regulation

Refer also to citation(s) 35677, 35678, 35683

35682 (NEB-SS–GH-2-87) **Reasons for descisions-TransCanada Pipelines Ltd. Requests pertaining to the installation and to the approval of the method of devising rights and of the connected questions about rates.** National Energy Board, Ottawa, ON (Canada). 1988. 154p. (In French). (MICROLOG–88-06005). Available from National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, , Canada K1A 0E5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In a claim dated June 9 1987, and modified on September 17 of the same year, TransCanada Pipelines Ltd. required authorization to build new installations in order to increase the capacity of its pipeline network so as to supply existing markets and to deliver additional exports in the northeast United States. The total cost of the proposed installations was evaluated at $334 M. TransCanada also requested that the method of sharing costs and of devising rights, currently used by the National Energy Board, be still applicable to these new installations. This report discusses successively the new installations and their projected costs, the motives of the decisions taken by the Board about TransCanada's claim, the method for forecasting the additional volumes of exports, the obtaining o f the necessary authorizations in the United States, the problems raised by the export contracts of Alberta North East Gas from Niagara Falls and Iroquois (the Board reserved its decision concerning them), the utilization of lands, the method of devising rights, the modifying agreement between TransCanada and Great Lakes, Gas Transmission Company, questions pertaining to rates, and the conditions of access to the pipeline network of TransCanada. 4 refs., 13 tabs.

0320 Transport, Pipelines, and Handling

Refer also to citation(s) 35674, 36466

35683 (ERCB–D89-4) **Applications by Phillips Petroleum Resources, Ltd. for permits to construct pipelines to transport sour gas and fuel gas in the salter field.** Energy Resources Conservation Board, Calgary, AB (Canada). 1989. 20p. (CE–02693). Available from Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, Canada T2P 3G4; $N/C.

This report details the process and decisions following applications by Phillips Petroleum Resources, Ltd. for permits to construct pipelines; to transport sour gas and fuel gas in Alberta's Salter Field. The subject applications involve the tie-ins of four sour gas wells in the Salter Field and the installation of a sour gas and a fuel gas pipeline to connect the wells to the existing gas plan. The proposed pipeline facilities will conform to all the necessary standards and requirements for sour gas operation which have been designed to ensure the public's safety. Given the overall safety record of sour gas pipeline operations in the province of Alberta, the Board is satisified that this pipeline can be operated with little risk to the public. The Board believes the issues for considertion of these applications to be the need for the pipelines, corridor selection, and route selection. The Board is prepared to grant applications by Phillips Petroleum Resources, Ltd. subject to receipt of the approval of the Minister of the Environment respecting environmental maters, and subject to the conditions and restrictions as discussed in the body of this report. 2 figs.

35684 (PB–89-180160/XAB) **Transport and Storage (3.3) Subprogram for Gas Research Institute: status report - 1988 projects.** Gas Research Inst., Chicago, IL (USA). Mar 1989. 147p. (GRI–89/0076). Available from NTIS, PC A07/MF A01.

See also PB–88-205877.

This status report presents descriptions of the major issues, objectives, initiatives, and strategies of the Gas Research Institute Transport and Storage Research (T and SR) Subprogram, which is part of the GRI Gas Operations Research and Development Program. Included are Contract Summary Reports on the status of each research project as of January 1, 1989 in the seven project areas of the T and SR Subprogram. These project areas are: construction and maintenance; metering and operations; plastic piping materials evaluation and development; residential/commercial interior piping systems; gas storage technology; transmission piping systems; and advanced systems and sensor technology.

35685 **Threshold-stress determination using tapered specimens and cyclic stresses.** Fessler, R.R. (Battelle Columbus Labs., Columbus, OH (US)); Barlo, T.J. v.v of Environment-sensitive fracture: Evaluation and comparison of test methods. Dean, S.W.; Pugh, E.N.; Ugiansky, G.M. ASTM, Philadelphia, PA (1984). (CONF-820495–: ASTM symposium on environment sensitive fracture: evaluation and comparison of test methods, Gaithersburg, MD, USA, 25-28 Apr 1982).

Traditional methods of determining the threshold stress for stress-corrosion cracking involve testing a number of specimens that are loaded to various levels of constant initial stress. In research sponsored by the Pipeline Research Committee of the American Gas Association, it was shown that low-frequency, small-amplitude cyclic loads superimposed on a constant load can reduce the threshold stress substantially. Since such loading can occur on real structures, it was felt that the threshold stress should be determined under those more severe and realistic conditions. Furthermore, by using a specimen with a tapered gage section, a range of stresses could be evaluated in a single test, making it possible, in principle, to determine the threshold stress with one or two specimens. Test procedures involving tapered specimens and cyclic loads superimposed upon a constant load are described, and representative data for various line-pipe steels are presented. The test environment consisted of a water solution of sodium carbonate and sodium bicarbonate, and the temperature was controlled at 352 K (175^{0}F). the potential was controlled potentiostatically at the center of the range in which stress-corrosion cracking occurs. Test duration typically were 1 to 2 weeks.

0330 Properties

35686 (PB–89-173678/XAB) **Study of data distributions and functions for the development of thermodynamic equations of state. Annual report, June 1987-May 1988.** Jacobsen, R.T.; Beyerlein, S.W.; Bjornn, K.R.; Ostic, J.; Clarke, W.P. Idaho Univ., Moscow, ID (USA). Center for Applied Thermodynamic Studies. Jul 1988. 42p. Available from NTIS, PC A03/MF A01.

See also PB–88-196365.

The objective of the research is to provide guidelines for efficiently measuring and correlating thermodynamic property data used in developing highly accurate equations of state for fluids used in the natural gas industry. Fitting experiments were conducted with pseudo-data calculated from a highly accurate equation of state for ethylene. Results of these experiments were analyzed using region by region summaries of random errors, three-dimensional plots, and contour maps showing local deviations in predicted properties.

0340 Combustion

35687 (PB–89-140883/XAB) **Enhanced flame stability and soot radiation using electric fields. Annual report, July 1987-July 1988.** Berman, C.H.; Gill, R.J.; Calcote, H.F. Aerochem Research Labs., Inc., Princeton, NJ (USA). Oct 1988. 57p. (AEROCHEM-TP–476). Available from NTIS, PC A04/MF A01.

Enhanced stabilization of methane-air flames was achieved by application of dc electric fields of only a few thousand volts with a minimum electric-power dissipation, about 0.01% of the combustion power being controlled. Both the lean blowoff composition and the maximum blowoff velocity are markedly affected. The mechanism for this phenomenon is discussed in terms of an effect of the electric field on the boundary velocity gradient. The electric field applies an electric force on the chemiions in the flame, producing an electric wind which forces the flame closer to the burner rim both reducing the dead space and decreasing the boundary velocity gradient. The 'boiling' effect on a flat flame due to the application of an electric field, reported previously, is explained by an electron-cascade effect in which thermally produced electrons are accelerated by the electric field producing more charged soot particles. In a counterflow flame, periodic waves are produced by the electric field; an explanation has not been developed. The counterflow and flat flame apparatus, including the laser optical system for particle measurements in the flame has been completely redesigned for more rapid and especially more accurate data collection.

35688 (PB–89-173603/XAB) **Compact ceramic heat exchangers. Final report, February 1983-June 1988.** Coubrough, L.E.; Dobos, C.J.; Kleiner, R.N. Coors Ceramics Co., Golden, CO (USA). Jun 1988. 131p. Available from NTIS, PC A07/MF A01.

The objective of the project was to develop and field test a durable compact ceramic heat exchanger for improved process efficiency in industrial gas-fired furnace. A unique aluminum titanate ceramic material and crossflow recuperator design was developed and analyzed in laboratory testing in 1983 and 1984. Testing of the recuperator performance and system benefits began in the heat-treating industry on three separate direct-fired furnace installations. Over five years of trouble-free operation has produced operating cost reductions of 30 to 45% and productivity improvements up to 16%. In 1985, testing on a box forge furnace at temperatures up to 2250°F has provided 30% fuel cost savings. In 1987, application of this technology is being extended to radiant tube systems through design and laboratory testing of counterflow radiant tube recuperator packages.

0350 Storage

Refer also to citation(s) 35684

04 OIL SHALES AND TAR SANDS

35689 (AOSTRA–8808) **UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.** Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. vp. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

A conference was held in Alberta to examine various aspects of heavy oil and oil sands research around the world. Papers were presented in the areas of drilling, recovery processes, upgrading, petroleum geology, economics, environmental issues, waste management, well completion, and oil sand or heavy oil analysis. Separate abstracts have been prepared for 46 papers from this conference.

35690 (AOSTRA–8808, pp. 7) **Legal framework for operation of government research and development agencies.** Hyndman, L.D. (Field and Field, Edmonton, AB, Canada); Spady, E.K. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The Alberta Oil Sands Technology and Research Authority was established as a Crown corporation in 1974 for the purpose of encouraging the orderly and efficient development of the important hydrocarbon resource known as the Alberta oil sands. The mandate of the Authority, its investments, its ties with other countries, with the industry, with universities and research organizations are discussed. The Authority has a policy of disseminating publicly-funded technology at fair market value and of sharing the revenues received with the inventor or developer, based on the respective contributions to a given research project. The role of the Authority is not to directly compete with industry, but to provide financial and technical assistance to encourage industry to undertake development earlier than it would normally. The crisis in world oil prices may cause a reconsideration of the methods of funding technology development and of marketing the resultant product. The industry has become reluctant to fund research projects, and therefore the Authority has become more active in technology transfer, so as to gain licensing revenues. In the institutional sector, which includes universities, the Authority considers more carefully the kinds of projects for which funds are allocated. The efforts of the Authority over the past 13 years, through research and development and through pilot programs, have resulted in cost reductions and increased recovery such that commercialization of oil sands and heavy oil deposits is now possible, and economically viable at less than US $20 /bbl. 36 refs.

35691 (CU/FCE–8903) **Challenges and innovations 1989. 6th Annual heavy oil and oil sands technical symposium.** Calgary Univ., AB (Canada). Faculty of Continuing Education. 1989. vp. (CONF-8903126–: 6. annual heavy oil and oil sands technical symposium, Calgary, Canada, 8 Mar 1989;CE–02591). Available from Faculty of Continuing Education, University of Calgary, 2500 University Drive, N.W., Calgary, AB, Canada T2N 1N4; $30.00 CAN.

The papers in this symposium include oil recovery by artificial lifts, in situ combustion, and water and steam injection; temperature logging; interwell communication; horizontal drilling; heavy oil upgrading plants in Alberta and Saskatchewan, with emphasis on design criteria and process selection; prevention of formation damage; and a new energy-saving process for visbreaking of bitumens. Experimental data obtained both on the spot and in the laboratory are presented. Separate abstracts have been prepared for 11 papers from this symposium.

35692 (DOE/FE–0133) **Tar sands program plan, FY 1989.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of the Deputy Assistant Secretary for Oil, Gas, Shale and Special Technologies. Jun 1989. 25p. Sponsored by DOE Fossil Energy. Order Number DE89013912/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The tar sands program is directed toward expanding the technical information base needed to develop advanced technologies for recovering oil from large, presently unrecoverable resources. The overall goal of the program is to foster industry development of economically competitive and environmentally acceptable recovery processes. Many technology barriers substantially limit development of the nation's tar sands resources to a small fraction of their potential as a source of petroleum liquids. Recovery process parameters are not fully understood; the amenability of deposits of varying chemical/physical makeup to different recovery process approaches needs further evaluation; and the expected variability of process cost factors, including the desirability of recovered products and the costs of mitigating process waste pollutants, requires research and assessment. The Department of Energy's (DOE's) technical objectives for the tar sands program relate to the research needs associated with specific functional and process information needs. These objectives are presented. 6 refs., 5 figs., 1 tab.

0401 Reserves and Exploration

Refer also to citation(s) 35699, 35729

0402 Site Geology and Hydrology

Refer also to citation(s) 35702

35693 (AOSTRA–8808, pp. 16) **Simulation of HASDrive UTF pilot.** Duerksen, J.H. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Heated Annulus Steam Drive (HASDrive) shows promise as an effective tar sand enhanced oil recovery process based on laboratory tests and simulation studies. The development of the Alberta Oil Sands Technology and Research Authority Underground Test Facility (UTF) in the Athabasca tar sand deposits has provided an opportunity to field-test the HASDrive process to confirm laboratory observations and validate numerical simulation results. The HASDrive pilot consists of a horizontal HAS pipe and a horizontal producing well, both drilled from a UTF tunnel; and a vertical steam injection well and six observation wells, all drilled from the surface. A pilot simulation study was conducted to predict steam injection rates, fluid production rates, reservoir temperatures, pressures and fluid saturations. The study evaluated the effects of the HAS pipe heat transfer coefficient, steam injection pressure and quality, and producer back pressure. The results of the simulation study presented in this paper provided design input for the HASDrive UTF pilot. 9 refs., 10 figs., 8 tabs.

35694 (AOSTRA–8808, pp. 2) **Fluvial, estuarine and shallow marine sedimentation in the Lower Cretaceous McMurray Formation and Wabiskaw Member (Clearwater Formation), in the central region, Athabasca oil sands area, northeastern Alberta.** Keith, D.A.W (Alberta Research Council, Edmonton, AB, Canada); Wightman .M.; Pemberton, S.G.; MacGillivray, J.R.; Berezniuk, T.; Berhane, H. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Examination of over 400 well logs and 34 cores allows determination of the geological setting, lithofacies patterns and depositional history of the McMurray formation and Wabiskaw Member of the Clearwater Formation in the central region of the Athabasca Oil Sands area. The principal control on sand distribution in central Athabasca is the topography of the underlying subcretaceous unconformity. This surface is generally low in the east and higher in the west toward the Paleozoic Grosmont High. The McMurray displays a corresponding thinning from greater than 100m in the east to less than 5m in the western part of the study area. A number of Paleozoic ridges control McMurray Formation sedimentation styles and can be used to divide the study area into two distinct regions: an eastern region with two valley systems and a western region. The eastern region is dominated by channelized McMurray Formation sands occurring within two valley systems. Deposition within the valley systems reflects transgressive valley fill sedimentation. Amalgamated fluvial channel and offchannel deposits generally initiate the successions and grade upward into brackish muddy deposits. Sandy estuarine sediments are also present in the middle to upper part of the McMurray. Marine Wabiskaw Member siltstones and mudstones blanket the eastern valleys. The western region shows no influence of the eastern valley systems. It consists of abrupt alternations of marine or brackish and continental deposits that probably accumulated within a bay fill setting. Here, thin tabular sands in the upper part of the McMurray Formation and thicker, laterally extensive sands in the Wabiskaw Member are developed. 17 refs., 30 figs., 1 tab.

35695 (AOSTRA–8808, pp. 18) **The McMurray formation in the Athabasca oil sands area: an ichnological and paleontological perspective.** Mattison, B.W. (Univ. of Alberta, Edmonton, AB, Canada); Pemberton, S.G. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Paleontologic and ichnologic study of the McMurray Formation in the Athabasca Oil Sands area reveals that this unit was deposited within a marginal-marine estuarine setting during the initial transgressive phase of the Lower Cretaceous Clearwater Sea. A depositional environmental evolution from coastal fringing lacustrine or paludal environments into a range of estuarine environments and finally into shoreface or nearshore shoal environments is recorded in vertical and lateral facies associations preserved in the formation. High-grade oil sand reservoirs are found within estuarine channels in the middle unit of the McMurray formation. Because of the high cost of oil sands mining procedures and because of the nature of the mining process itself, mapping the trends of these channels is extremely important, since accurate prediction of channels allows for the extraction of oil sand with the mining of as little waste rock as possible. Ichnologic trends within both channelized and nonchannelized deposits in the middle member of the formation indicate proximal and distal relationships to sandy channelized reservoirs. Recognition of distinct suites of trace fossils within this unit may thus be an economically invaluable facies mapping tool. 43 refs., 8 figs.

35696 (AOSTRA–8808, pp. 20) **Geology and resources of the primrose crude bitumen deposits northeastern Alberta.** Beckie, K.N. (AEC Oil and Gas Co., Alberta Energy Co. Ltd., Calgary, AB, Canada); McIntosh, R.A. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The large 5200 km^2 Cold Lake Air Weapons Range (Primrose Block) was unexplored prior to 1978. Since then, aproximately 8 x 10^9 m^3 of in- place crude bitumen plus significant volumes of natural gas have been delineated. These oil sands represent the southern limits of the giant Athabasca deposit and northern limit of the Cold Lake deposit. The Primrose Block straddles the regional, southerly plunging Athabasca anticline which is the primary controlling factor for entrapment of these oil sand deposits. The crude bitumen resources occur largely in two deltaic sand bodies within the Clearwater Formation and within fluvial sands of the McMurray Formation. Both of these formations are part of the Lower Cretaceous Mannville Group. The McMurray consists of quartzarenites to subarkosic sands with a significant compositional change in the overlying Clearwater Formation to litharenites. Both formations exhibit shallow burial and high primary porosities (averaging 34% to 38%). There is also some secondary porosity developed in the Clearwater Formation due to framework grain dissolution. Permeabilities in the Clearwater, particularly in its basal Wabiskaw Member, have been reduced considerably by the presence of authigenic and detrital clays. The average range in permeabilities is from 2 to 4 darcies. 7 refs., 14 figs., 1 tab.

35697 (AOSTRA–8808, pp. 20) **A quantitative approach to the geological evaluation of the tar sands of south Athabasca, Alberta.** Ranger, M.J. (Univ. of Alberta, Edmonton, AB, Canada); Pemberton, S.G. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

In the South Athabasca area, traditional approaches to determining the spatial distribution of the bitumen resource, as well as the

spatial variation in its physical and chemical properties, are becoming untenable due to the vast and ever-increasing amount of available data. An ancient horizon that can be used for structural studies is the erosional unconformity at the base of the McMurray Formation reservoir. There are many anomalies in the relationship between the formation thickness and the structure on the unconformity, and these anomalies can be differentiated into three distinct populations. Resolving these populations using multivariate statistical analysis and mapping the results provides new insight into the basinal structure and suggests the presence of major normal faults parallel to the basin strike and downthrown to the southwest. A rigorous and objective analysis of geophysical well logs has also been performed. Using new techniques for digital pattern recognition, particularly the application of spectral analysis using the Fourier transform, enables curve patterns to be quantified numerically. The magnitude of the spectral coefficients of the curves can be used to compare and correlate patterns from well to well with the help of cluster analysis techniques. These techniques are realizing their potential to provide a new geological perspective of the South Athabasca basin. 11 refs., 13 figs., 2 tabs.

35698 (AOSTRA–8808, pp. 21) **Geology of the AOSTRA underground test facility site.** Rottenfuss, B.A.; Palfreyman, J.E.; Alwast, N.K. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

At the Alberta Oil Sands Technology and Research Authority Underground Test Facility (UTF), three horizontal well pairs have been drilled up into the overlying Cretaceous oil sands from tunnels within the underlying Paleozoic carbonates. Each well pair consists of an injection well and a production well, located at approxomately 7m and 2m above the base of the oil sands, respectively. Steam is supplied by injection into the overlying well of each horizontal pair and the condensate and bitumen are collected from the underlying well. A grid of 28 vertical boreholes penetrates the area around the horizontal wells. An extensive suite of geophysical logs and 514 M of core (supplemented by core analysis for grain size, bitumen saturation, porosity and permeability) provide the basis for a detailed geological characterization of the reservoir. At the UTF site, the Cretaceous McMurray Formation is 37m thick. The bottom 20m of rich oil sands is interrupted by several shaly zones. Most are either shale breccias or heavily burrowed shales, both of which are likely to have some vertical permeability. Overlying the rich oil sands, 17m of interbedded oil sand and shale grade up to a sandy shale at the top of the formation. The McMurray is overlain by 2m of water saturated Wabiskaw sand which is capped by thick shales of the Clearwater Formation. The objective of the geological studies is to provide the parameters to build a detailed reservoir model that reflects the heterogeneities of the test site. The model will be instrumental in evaluating the effect of geology on development of the steam chambers during the life of the pilot. 6 refs., 15 figs.

35699 (AOSTRA–8808, pp. 25) **Resource characterization of the central region of the lower Cretaceous McMurray/Wabiskaw deposit, Athabasca oil sands area, northeastern Alberta.** MacGillivray, J.R. (Alberta Research Council, Edmonton, AB, Canada); Wightman, D.M.; Keith, D.A.W.; Bell, D.D.; Berhane, H.; Berezniuk, T. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The McMurray/Wabiskaw Deposit (Mannville Group) of the Athabasca Oil Sands area is the largest bitumen deposit in Alberta. A suite of isopach maps (total sands, oil sands) of the McMurray Formation and Wabiskaw Member of the Clearwater Formation have been prepared between Townships 80 to 90, ranges 1 to 18w4. Water sands, bottom water sands, and gas sands isopach maps were also prepared for the McMurray Formation. Bitumen distribution is closely related to sand distribution and the bitumen trapping mechanism appears to be a result of stratigraphy, structure, and biodegradation. Topography on the sub-Cretaceous unconformity resulting from differential erosion and salt dissolution has controlled McMurray Formation deposition. In contrast to the McMurray Formation sedimentation that infilled topographic lows on the sub-Cretaceous unconformity, the overlying Wabiskaw Member was developed on a flatter surface. The various regions of both formations are discussed. 19 refs., 19 figs.

0403 Drilling, Fracturing, and Mining

Refer also to citation(s) 35609, 35720, 36239, 37415

35700 (AOSTRA–8808, pp. 13) **Calculating the maximum horizontal wellbore length.** Carden, R.S. (Grace, Shursen, Moore and Associates, Amarillo, TX, USA). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The question often arises as to how much horizontal wellbore can be drilled, as the length of the horizontal wellbore will be limited by drag, torque and pipe stresses. A simple mathematical model was developed to predict the amount of torque and drag in a horizontal well. In most directional wells, the drag while pulling pipe is the limiting factor. However, in horizontal wells, the drag while running pipe (down drag) and the torque are usually the limiting factors. The down drag is further complicated when buckling imposes an additional drag force which can exceed the weight of the pipe even in the vertical portion of the well. Therefore, the pipe will no longer fall into the well. The model can be used to determine the point at which buckling occurs, and steps can be taken to minimize the effect. Pipe stresses are another major concern in drilling horizontal wells. Cyclic stresses in high dogleg severities can cause drill pipe fatigue. Many times in horizontal wells, the torsional stresses will exceed the stresses caused by axial tension, and therefore must be considered. Methods for determining the maximum allowable pipe stresses are presented. The model can be used to design a well with the maximum amount of horizontal wellbore or to efficiently design a shorter horizontal well. The model calculations can be easily programmed into a hand-held calculator. 7 refs., 8 figs.

35701 (CHOA–8808, pp. 11) **Hydraulic fracturing improves steam placement and oil recovery.** Theriault, D.J. (AEC Oil and Gas Co.); Jenkins, G.R.; Naderi, N. Canadian Heavy Oil Association (Canada). 1988. (CONF-8808237–: Thermal well completions seminar, Edmonton, Canada, 11 Aug 1988;CE–02660). In *Thermal well completions seminar.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

Selective steam placement within the formation and potential production impairment from fines migration are important factors to consider during initial well completion design in cyclic steam stimulation projects. Typically, in thick formations, only the lower portion of the zone is perforated, to minimize the anticipated steam override. This practice may be unfavorable in reservoirs with zones of varying quality or higher water saturation. Additionally, high fluid velocities during steam injection and/or production can mobilize fines and cause near wellbore damage. This paper discusses a completion strategy that improves the injection profile and reduces the potential for fines migration. Initial pilot results, where the Wabiskaw formation was fractured during steam injection, were not sufficient to justify commercial operations. Experimentation with propped fracturing techniques prior to steam injection led to the conclusion that further testing was warranted. Two phases of propped fracture programs have been successful in improving the injection profile, and have achieved a substantial improvement in production response over multiple cycles. Calendar day oil rates have been improved by up to 100%. The program design and operational procedures were

chosen in order to initiate a horizontal fracture; the temperature and pressure data collected after steam injection suggest that this was obtained. 2 refs., 5 figs., 1 tab.

0404 Oil Production, Recovery, and Refining

Refer also to citation(s) 35603, 35604, 35623, 35624, 35625, 35626, 35627, 35628, 35629, 35636, 35637, 35639, 35701, 35733, 36467, 36468, 36470, 36471, 37415

35702 (AOSTRA–8808) **UNITAR/UNDP, 4th international conference on heavy crude and tar sand. Vol. 1.** Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. vp. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Many papers in this volume deal with the steam stimulation of oil sands deposits in various countries: Canada, USA, Venezuela, Trinidad, Brazil and Kuwait. The underground test facility at Fort McMurray, Alberta, is presented. One case in Venezuela involves steam stimulation of a deposit at 2500m depth. Some research papers deal with reservoir fracturation and subsidence and with the porosity-permeability relationship, in connection with the steam stimulation technique. A few papers deal with hot water stimulation in the Athabasca deposits. Some research papers present laboratory data and models on bitumen detachment and the composition of the tailings in the hot water process. The conditions of granting permits in Alberta and California, the activities of the AOSTRA (Alberta Oil Sands Technology and Research Authority), the stratigraphy of some of the Athabasca deposits, and the economic feasibility of a project in Madagascar are discussed. All twenty-three papers have been abstracted.

35703 (AOSTRA–8808, pp. 6) **The regional upgrader concept for oil sand development. Brief overview.** Yildirim, E. (ARC Oil Sands Task Force, AB, Canada). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Sustained development of Alberta's unconventional energy resources cannot be done without serious consideration for processing to upgrade the quality of these heavy hydrocarbon projects. Two current operations, Suncor and syncrude Canada, producing bitumen through surface mining and extraction steps are integrated plants fully equipped with upgrading process units. However, there are no upgraders at the sites of in-situ operations even though the integrated plant configuration is also available in conjunction with these applications. There are other upgrading alternatives to integrated plants, but this paper focuses on the regional upgrader option. The proposed concept involves the establishment of a regional upgrader in Alberta as a common facility for processing bitumen feedstock supplied by a number of mineable oil sands and in-situ production operations. The configuration described involves satellite production facilities on mineable as well as in situ oil sand leases A preliminary evaluation of the proposed concept confirms the viability of the regional upgrader concept in relation to the more conventional integrated plant development approach. Based on supply cost economics, the cost of synthetic crude production would be in the range of $29.11 to $33.66/bbl. The level of precision in the study is adequate to show general trends and conclusions. The supply cost estimates may be conservative and may not reflect achievable potential improvements. Measured strictly by the return as an investment criterion, the construction and operation of an upgrader is not economical under the current oil price scenario. Measured in terms of social benefits, however, the concept offers immense returns to Alberta and Canada. 8 refs., 1 fig.

35704 (AOSTRA–8808, pp. 20) **Syncrude processing in conventional refineries.** Galiasso, R. (INTEVEP, S.A., Caracas, Venezuela); Hallensleben, Y.; Perez, P.; Boltz, K.; Badra, C.; Serpemen, Y. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

A new tool for simulating the operation of conventional refineries with syncrudes was developed. Extensive experimental work was done to develop correlations that could predict the characteristics of the products obtained from hydrotreatment, reforming, catalytic cracking and hydrocracking units with synthetic feedstocks. The results were compared with those obtained from processing typical commercial feedstocks, and the resultant correlations were integrated in a new program, based on the Lotus 1-2-3 spreadsheet package, for the calculation of the price of the syncrude by netback procedure. Results indicate the effects of quality and reactivity on the processes investigated. Aromatics and hydrogen carbon ratios (H/C) seem determinant properties in comparison with those of the reference virgin crude oil. Complex refineries could valorize low quality syncrude if hydrotreatment is available to internally increase the H/C ratio. 10 figs., 10 tabs.

35705 (AOSTRA–8808, pp. 15) **Coking of oil sand, asphaltenes and residual oils in the LR-process.** Weiss, H.; Schmalfeld, J.; Solari, R.B. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

A fundamental conversion principle to shift the hydrogen to carbon ratio in liquid hydrocarbons is carbon rejection or coking. The unique features of the Lurgi-Ruhrgas (LR) flash coking process are presented, and its development status with regard to the coking of oil sand, asphaltenes, and residual oils is described. Several bench and pilot plant tests have recently been performed on various feedstocks including vacuum residue, asphaltenes and coal tar pitch. Some results from these tests are presented. It is felt that inclusion of deasphalting and LR flash coking into a heavy oil refinery complex is an attractive option to enhance product recovery and quality. The processes play an important role in future deep conversion technologies required to balance the increasing gap between demand for light distillates and supply of heavy crude oils in the world market. 8 figs., 3 tabs.

35706 (AOSTRA–8808, pp. 12) **Developments in upgrading of bitumen by hydropyrolysis.** Bunger, J.W. (Univ. ofUtah, Salt Lake City, Utah); Tsai, C.H.; Ryu, H.; Devineni, P. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Hydropyrolysis, a short residence time, moderate temperature process, has been shown to produce 90+% liquid product yields from feedstocks containing more than 50% nonvolatile materials. The process results in extremely low coke yields. Detailed studies of the chemistry reveal that hydrogen is responsible for the low coke production through hydrogenation reactions, accelerated cracking and dealkylation reactions, and through inhibition of aromatic bimolecular reactions. In the process regime studied, dealkylation reactions, those responsible for cracking of side chains and of ring opening of naphthenoaromatic compounds, are the most rapid. Hydrogen consumption is modes at low gas production levels. A hydrogen balance has been performed as it relates to hydrogenation and dehydrogenation reactions occurring. Results suggest that there may be a limit as to how short a residence time and how high a temperature can be utilized and maintain high liquid

and low gas yields. Preliminary considerations of a commercial sized plant reveal that costs must be minimized to ensure profitability. 16 refs., 5 figs., 2 tabs.

35707 (AOSTRA–8808, pp. 14) **Reservoir plugging/blocking using ultramicrobacteria: Three-dimensional physical simulator results.** Singh, S. (Alberta Research Council, Edmonton, AB, Canada); Nguyen, D.; Grieco, J.; de Rocco, M.; Costerton, B.; Cusack, F.; Lappin-Scott, H. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Ultramicrobacteria are bacteria which are small enough to permeate through a sand pack. Upon injection of a suitable nutrient, they can be resuscitated to multiply and produce enough polysaccaride slime to cause plugging. This method does not depend on an initial dispersion concentration of the ultramicrobacteria but rather on a well-designed nutrient package. To advance development of bacterial plugging under simulated field conditions, experiments were conducted in a three-dimensional physical simulator. The simulator consisted of a 45cm diameter, 30cm height pressure vessel which was packed with Ottawa sand, to simulate the unconsolidated medium associated with heavy oil and oil sands formations. It was equipped with specially designed injection/production wells and a number of sampling/pressure probes distributed throughout the pack. Following the injection of the ultramicrobacteria and the nutrient solutions, results from pressure drop measurements, on-line sampling and from sessile samples and cores indicated that ultramicrobacteria had penetrated the pack in all directions and that under nutrient stimulation, they had grown/multiplied into colonies. Bacterial polymer polysaccharide was evident throughout and permeabilities had been reduced to a fraction of their original values. 3 refs., 10 figs., 7 tabs.

35708 (AOSTRA–8808, pp. 17) **Analysis and implementation of the steam assisted gravity drainage process at the AOSTRA UTF.** Edmunds, N.R.; Haston, J.A.; Best, D.A. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The Alberta Oil Sands Technology Research Authority is the operator of the Underground Test Facility (UTF) which has been constructed to enable the testing of mine-assisted in situ recovery processes, using horizontal wells drilled from tunnels below the pay zone. One of the test programs currently underway at the UTF is a six well test of steam assisted gravity drainage (SAGD). The well layout consists of three pairs of horizontal wells. Each well pair has a producer completed 2-3m above the base of the pay and an injector about 5m above the producer. The well pairs are spaced 25m apart and the effective length of each pair is about 60m. This paper concentrates first on the detailed mechanisms of SAGD in an oil sands context including numerical solutions of drainage problems. The engineering considerations involved with implementing the conceptual process in field hardware are also discussed. Steam assisted gravity drainage can be understood in terms of two distinct modes, namely ceiling and slope drainage. Ceiling drainage is controlled by countercurrent transport in the steam zone immediately below the front, whereas slope drainage is controlled by bitumen transport just ahead of the front. This in turn depends on conduction heating. Ability to predict UTF drainage rates is severely limited by the random, numerous, and small scale heterogeneities present in the McMurray formation. The test program was therefore designed to directly gather data on drainage rates. Considerable development of complementary technology, particularly drilling and completions, was necessary to implement the test. To date the field results have been more than satisfactory, and it appears that the test program will achieve its objectives. 13 refs., 12 figs., 2 tabs.

35709 (AOSTRA–8808, pp. 28) **A theoretical and experimental study of steam-assisted gravity drainage process.** Chung, K.H. (Univ. of Calgary, Calgary, AB, Canada); Butler, R.M. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

New experimental results are reported on physical model studies of the steam-assisted gravity drainage (SAGD) process for recovery of heavy oil from tar sands. Two similar physical models were constructed: one operating near atmospheric pressure and one at pressures up to 3.55 megapascals. The model used a preheated vertical steam injector which was perforated near the top of the formation and a horizontal producer at the base of the formation. The model packing was chosen to provide dimensional similarity with specific field conditions. The experimental results were in general agreement with those predicted by an extended version of an existing theory. The scaling procedure used for the SAGD process was found to be satisfactory in predicting the experimental performance at various operating conditions. The viability of using a preheated vertical injector to establish initial communication between the injection and production wells was illustrated experimentally. A closer spacing between the horizontal wells improves the efficiency of the SAGD process. The ultimate recovery is independent of the well spacings. 9 refs., 21 figs., 5 tabs.

35710 (AOSTRA–8808, pp. 13) **Optimum cementing and gravel packing methods for unconsolidated heavy oil sands.** Machado, P. (Petroleos de Venezuela, SA); Moya, J.; Figueredo, C. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

A review is presented of existing practices and improvements implemented for primary cementing and gravel packing techniques applied in the Hamaca Area of the Orinoco Heavy Oilfield. Actual completion techniques employed are shown to be acceptable. However, state of the art procedures have motivated several improvements that have insured technically successful results for both cementing and gravel packing operations. Present development includes vertical and directional wells, completed either with inside or open-hole gravel packs. Cementing operations are achieved by using a thixotropic slurry which is pumped at high rates. A variation of additives is employed to control cement properties. Silica flour in the cement slurry is used and casing prestressing has been applied in anticipation of thermal stresses. Failures in sand control have been observed after cyclic steaming. The main causes for sanding seem to be failures at the linear hanger device and limited quality of available gravel. After extensive analyses, conclusions indicate that cement slurries should be displaced in the plug flow regime, with strict control of chemical additives. Consideration of casing behavior under thermal stresses indicates that prestressing is unnecessary. Changing the sand control adapter for a metal to metal type and better control of the steam's pH should improve the performance from completed wells. 24 refs., 5 figs., 3 tabs.

35711 (AOSTRA–8808, pp. 14) **A pressure observation well for monitoring and optimizing the pressure-up blowdown combustion process.** McGee, B.C.W. (BP Resources Canada Ltd., Calgary, AB, Canada); Hallam, R.J.; Nzekwu, B.I.; Galas, C.M.F. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The Alberta Oil Sands Technology and Research Authority has been developing the patented Pressure-Up Blowdown combustion process, as a follow up to cyclic steam stimulation, in a pilot on the Wolf Lake lease. During the pressure-up phase, oxygen for in-situ combustion and water are injected into the reservoir, while the surrounding producers are controlled to distribute the heat and to increase the reservoir pressure within the channel system. Oxygen injection is terminated to initiate the blowdown phase, and the producers are operated without restriction to depressure the reservoir. The pressure-up blowdown sequence is then repeated a number of times. To monitor the development of the steam and combustion zones within the reservoir a number of observation wells have been used in the pilot. One of these wells was a pressure observation well, intentionally drilled into the cold part of the oil sand reservoir, away from the depleted, heated channels, to monitor the pressure response characteristics of the reservoir. The data collected from the pressure observation well have been used to interpret: the direction of fluid flow in the reservoir during the oxygen and water injection phases; the volume of oxygen required to pressure-up the reservoir; and the effective transmissibility of the formation during the presure-up and blowdown phases. Analysis of the data has shown that the extent of invasion of the colder regions of the reservoir, by the steam formed from the heat scavenging water, is dependent on the operating strategy. To achieve efficient heat transfer either multiple, small oxygen-water slugs or the coinjection of water and oxygen is required. The paper also compares the field data to numerical simulation used to support the interpretation of the process. 7 refs., 12 figs.

35712 (AOSTRA–8808, pp. 14) **Use of small scale ART processing for wellhead viscosity reduction and upgrading of heavy oils.** Dennis, G.E. (Engelhard Corp., N.J., USA). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Heavy crude oils usually require heat for production and diluent for transport. These two major components of operating cost can be substantially reduced through the application of Engelhard's ART process at the wellhead. ART is a commercial, short contact time carbon refection process which produces high yields of upgraded crude having reduced gravity and viscosity. From the low value, asphaltenic portion of the crude, ART generates surplus recoverable energy as fuel gas and steam. The need for transport diluent is eliminated while meeting 25 to 40% of the crude oil production steam requirements. The ART process offers a minimum cost means of primary upgrading via multiple small-scale modular units. The crude product can be blended into suitable refinery crude slates for finishing. This paper provides case study information on the cost and performance of the wellhead ART facility processing Cold Lake bitumen and attempts to bracket the upgraded crude value which could be realized. The cost of ART processing a barrel of bitumen is compared to the value added to this barrel of bitumen by ART processing. 5 refs., 6 figs., 8 tabs.

35713 (AOSTRA–8808, pp. 8) **Mild thermal conversion of Cold Lake bitumen.** Sankey, B.M. (Esso Resources Canada Ltd., Calgary, AB, Canada); Wu, F.S. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

In order to enable pipeline transportation of Cold Lake bitumen and similar heavy crudes, current practice is to add a light diluent such as naphtha. As bitumen production increases, there is no guarantee that diluent supply will keep pace. Consequently, alternative means of viscosity reduction are required. One of these, namely mild thermal conversion (MTC), has been investigated in laboratory, pilot plant, and engineering studies. Any processing of bitumen introduces chemical changes and these can affect product quality. Information is presented on properties of the various product fractions from MTC, including asphalt, often a key product from Cold Lake bitumen. For the refiner using bitumen as feed to a conversion unit, the perspective is somewhat different since MTC simply represents a point on the path to complete bottoms conversion. Implications for this situation are also discussed. The degree of diluent reduction can be altered by adjusting the processing severity of MTC, which in turn affects the product quality. The relationship of these together with the relevant engineering issues are described. Capital and operating costs plus other socioeconomic factors are presented for MTC along with economic benefits. It is concluded that MTC can provide a viable means of reducing dependence on diluent supply when moving bitumen from production site to market. While benefiting from similar existing commercial experience, the MTC process incorporates new findings which show that historic quality concerns about thermally converted products can be managed by appropriate design, and optimization of process/quality factors. 8 refs., 3 figs., 6 tabs.

35714 (AOSTRA–8808, pp. 14) **Oil sands formation preheating study.** Farouq Ali, S.M. (Univ. of Alberta, Edmonton, AB, Canada); Verma, A. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Canada's oil sands in the McMurray and Wabiskaw formations of the Athabasca deposits are immobile at their native reservoir temperatures. However, if the reservoir temperature is increased the viscosity drops and the oil becomes mobile. Various methods of formation heating were investigated for both the McMurray and the Wabiskaw formations. Numerical simulations were carried out to determine the effectiveness of formation heating by cyclic steam stimulation, steam injection followed by a long soak period, steam injection at a high rate over a limited interval, and in-situ combustion over a limited interval, followed by a shut-in period. It was found that cyclic steam stimulation was more effective than the other methods for formation heating. Steam injection followed by a long soak period was only marginally more effective in expanding the heated zone. However, it had the disadvantage that no oil was produced during the long soak period, unlike cyclic steam stimulation. Steam injection over a limited interval at a high rate could not be achieved in the case of McMurray and in-situ combustion resulted in uneven heating. It was concluded that cyclic steaming offered the best economic prospect for preheating the formation. 1 ref., 12 figs.

35715 (AOSTRA–8808, pp. 27) **Optimization of heavy oil thermorecovery made possible with a novel in-situ process.** Toma, P. (Alberta Research Council, Edmonton, AB, Canada); Reitman, V.; Redford, D. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

In order to improve the distribution of hot fluids injected in a heavy or extra-heavy oil reservoir and to control the development of production using a drive process, an array of horizontal sand-filled channels connecting a pattern of vertical wells was suggested. A sensitivity study aimed at determining the effect of the geometry and permeability of the sand-filled channels on the steamdrive recovery process is presented. The study, using numerical simulation, indicates that the optimum permeability for the sand-filled channels depends mainly on the permeability and viscosity of the oil sand formation. Avoiding the occurrence of channel plugging subsequent to the start-up of steam injection represented another essential constraint for designing the recovery process. Net economic and recovery process advantages were obtained when several levels of

channels were used rather than a single level, particularly for low permeability or high layered reservoirs. 34 refs., 18 figs.

35716 (AOSTRA–8808, pp. 14) **Insolation and characterization of non-bituminous organic materials which may interfere with recovery of bitumen from oil sands.** Sengupta, S. (Univ. of Calgary, Calgary, AB, Canada); Hall, E.S.; Tollefson, E.L. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Organic material, referred to in this paper as non-bituminous combustibles, concentrates in the centrifugation plant tailings from the hot water process and is not soluble in the normal solvents that are used to dissolve bitumen, such as toluene or chloroform. The presence of this material may contribute to losses of bitumen and naphtha to tailings. This paper describes the effects of sequestering agents on the flotation and gravity separation processes that have been employed to isolate the non-bituminous organic materials. The observed effects of sequestering agents have been used to develop a conceptual model of the interactions between bitumens, minerals, and the insoluble non-bituminous materials. Analytical and spectroscopic techniques indicate that the insoluble organic materials isolated have low ash but high oxygen contents. The sulfur content is less than that of bitumen. The thermal content is comparable to that of lignite coal. 37 refs., 6 figs., 5 tabs.

35717 (AOSTRA–8808, pp. 6) **Athabasca mineable oil sands. The RTR/Gulf extraction process theoretical model of bitumen detachment.** Corti, A. (RTR Oil Sands Ltd., Calgary, AB, Canada); Dente, M. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

In 1979, RTR operated a large pilot plant (20 ton/h) for bitumen extraction from the Athabasca oil sands. A modified hot water process was tested. On the basis of the experimental results, a simplified theoretical model for bitumen detachment from the sand grains was proposed. Three main equations describe the model in terms of bitumen detachment velocity, bitumen droplet size, and amount of connate water remaining with the bitumen. From the characteristics of the model, the analyses, and experimental observations, it is concluded that the oil sand is a complex system that presents an internal natural velocity for the bitumen detachment. The best results are obtained when the external process conditions and the internal surface energies are properly balanced. The gentle conditioning developed and proposed for the RTR/Gulf Extraction Process is one way of satisfying this requirement. 4 refs., 3 figs., 3 tabs.

35718 (AOSTRA–8808, pp. 10) **Selection and evaluation of diluents in the modified hot water process.** Yang, Y.J. (Univ. of Utah, Salt Lake City, Utah, USA); Bukka, K.; Miller, J.D. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The modified hot water separation process, developed at the University of Utah, has been found to be applicable to U.S. tar sands of low and medium viscosity bitumen (1-50 pascal-records at 50^{0}C). But when applied to tar sands containing very high viscosity bitumen (1500 pascal-records at 50^{0}C), the same level of success was not achieved. The principal difference in the modified hot water process is the control of bitumen viscosity by the addition of diluent to the tar sands. Earlier studies have shown that improved separation coefficients can be achieved by proportioning the addition of diluent to the tar sands in a manner such that the bitumen viscosity in the source material falls to a value in the range of 0.5-1.5 pascal-records. Kerosene has been the choice dilent used in the studies so far. This paper attempts to optimize the viscosity reduction of the bitmen in tar sands by varying the nature of the solvent. Industrial solvents such as kKerosene, SC-2, SC-150, cyclohexane, and ethyleneglycol-di-butylether have been used and the bitumen samples are derived from Utah Sunnyside, P.R. Spring, and Asphalt Ridge, which are representatives of low and very high viscosity bitumens. Viscosity measurements as a function of temperature have been achieved on the bitumens with the diluents. It was found that SC-150 is the most efficient in reducing the viscosity of bitumen. In order to verify these conclusions, two diluents, kerosene and SC-150, were used in the hot water processing of Sunnyside tar sands. 13 refs., 3 figs., 8 tabs.

35719 (AOSTRA–8808, pp. 5) **In defense of the Clark hot water process.** Rose, D.E. (Dereng Enterprises Ltd., AB, Canada). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Commercial production of bitumen from surface operations in the Athabasca Oil Sands region has utilized the Clark Hot Water Process since startup in 1967. From a materials handling and process efficiency standpoint, the process has proven successful. A large amount of engineering effort has been devoted to its development and improvement; much of the technology is directly applicable to alternative processes and other industries. Despite successful operation, many areas within the extraction operation have proven troublesome since startup, and will be faced in one form or another by future operators, even if an alternative process is utilized. A strategy supported by both government and industry should be developed to direct greater research and engineering effort toward resolution of these problems. 10 refs., 3 figs.

35720 (AOSTRA–8808, pp. 18) **Geotechnical instrument tation of the AOSTRA mine-assisted underground steaming trial.** Laing, J.M. (Thurber Consultants Ltd., Edmonton, AB, Canada); Scott, J.D.; Stokes, A.W.; Suggett, J.C.; Wood, D.F. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The Alberta Oil Sands Technology and Research Authority (AOSTRA) Underground Test Facility (UTF) located near Fort McMurray, Alberta, is currently being used to test the shaft and tunnel access concept for bitumen recovery. The project consists of tunnels that have been developed at a depth of 178m in the Devonian Formation limestones immediately beneath the oil sands to allow a trial of steam assisted gravity drainage recovery of bitumen from overlying oil sands. Trial steaming began in late 1987 and the first phase is planned to continue until early 1989. Seven participants have joined AOSTRA in funding the first phase tests. Under the co-sponsorship of AOSTRA and CANMET (Canada Centre for Mineral and Energy Technology), an extensive program of geotechnical instrumentation has been installed to monitor the response of the ground to the steaming operations. Instruments installed from underground are meant to ensure the integrity of the underground openings and wells, whereas those installed from the surface are to assess the geotechnical response of the reservoirs to the recovery process. The instruments that have been installed comprise thermocouples, thermistors, piezometers, extensometers, horizontal deflection monitoring wells, and tunnel convergence arrays. Readings obtained have generally indicated excellent instrument performance. In future, the monitoring is intended to provide previously unavailable data on the response of a formation throughout the development of

a steam zone; it is to be supplemented by numerical modelling and laboratory testing of core samples. 5 refs., 16 figs.

35721 (AOSTRA–8808, pp. 16) **AOSTRA underground test facility: mining access for research and production.** Haston, J.A. (Northwest Mine Services Ltd., Calgary, AB, Canada); O'Rourke, J.C.; Kovalsky, J.A.; Luhning, R.W; Greenwell, J; Bohme, C.G. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The Underground Test Facility (UTF) project, located north of Fort McMurray, Alberta, Canada, has been initiated by the Alberta Oil Sands Technology and Research Authority to investigate markedly new approaches to in situ recovery from Athabasca. Now well established in its process testing stage, the project is based on thermal process applications implemented through horizontal wells placed in the oil sands from an underlying tunnel system. This paper discusses the project site, project facilities, mining and drilling, underground process operations, safety, and costs. The initial results have been very encouraging. The UTF project aims at overcoming the basic problems of interwell communications development and maintenance. Studies have shown that the UTF processes offer the prospect of excellent oil/steam ratios with acceptable production rates, plus the promise of high ultimate recovery. More detailed discussion of the process piloting and of related programs is given in companion papers. 11 refs., 9 figs.

35722 (CHOA–8808) **Thermal well completions seminar.** Theriault, D.J. (ed.). Canadian Heavy Oil Association (Canada). 1988. vp. (CONF-8808237–: Thermal well completions seminar, Edmonton, Canada, 11 Aug 1988;CE–02660). Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

Papers presented at this seminar cover subjects associated with thermal oil recovery, especially heavy oil recovery. Techniques for well completion, steam stimulation, and reservoir fracturing are presented. Oil recovery may also be optimized by drilling radial horizontal holes with new equipment. Geotextile filters for sand control, new steels that resist thermal fatigue and hydrogen sulfide corrosion, premium casing connections, the use of thermally insulated well casings, and a new model of beam pump are also discussed. Separate abstracts have been prepared for 11 papers from this seminar.

35723 (CHOA–8808, pp. 14) **New developments in beam pumping technology PC 3000.** Cockshutt, D. (Alberta Energy Co., AB, Canada); Thomas, W. Canadian Heavy Oil Association (Canada). 1988. (CONF-8808237–: Thermal well completions seminar, Edmonton, Canada, 11 Aug 1988;CE–02660). In *Thermal well completions seminar.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

This paper describes the technical analysis of a new type of beam unit that does not use a crank and pitman arm drive configuration, but a power cylinder and tension belt system to provide pump motion suitable for heavy oil production. A theoretical analysis of the new beam unit substantiated the manufacturer's performance claims. Benefits of the new unit include increased production, fewer operational difficulties, and less operator input. For a given pumping speed, horsepower requirements are 2/3 less. Full control over the imposed rod motion will furthermore allow reductions in rod stress for a given pumping speed. Gear box torque overloading problems are completely avoided by not using rotary crank counterbalancing. The electronic control system of the pump is explained. 7 refs., 7 figs., 2 tabs.

35724 (CHOA–8808, pp. 11) **Mobil Oil Canada's use of insulated tubulars in thermal projects.** Kutzak, A.R. (Mobil Oil Canada Ltd., Canada); Gunn, D.W. Canadian Heavy Oil Association (Canada). 1988. (CONF-8808237–: Thermal well completions seminar, Edmonton, Canada, 11 Aug 1988;CE–02660). In *Thermal well completions seminar.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

Mobil Oil Canada Ltd. has a number of steam projects in its Canadian heavy oil properties. In order to optimize the overall economic performance and cost of these projects, various well completion designs, including insulated tubing, have been utilized. This paper discusses some factors that were assessed prior to deciding on the use of commercially available insulated tubulars, and Mobil's experience to date with these tubulars. Major factors considered included thermal energy losses through the wellbore and extended well life. Furthermore, physical characteristics of insulated tubing, including collar life and insulation degradation, required evaluation. Overall project economics embodied these parameters. The conclusions of the paper are the following: insulated tubulars are useful in steam injection service, but the benefits must offset both the original purchase cost and the servicing costs; insulated tubing reduces the possibility of casing failure due to thermally induced stresses; well designed completions result in maximum benefit from insulated tubing; new insulation systems permit designing for longer insulated tubing life, especially in H_2S environments; determination of operational requirements before ordering insulated tubing provides correct design; and adequate inspection in the manufacture of the thermal tubing ensures that all aspects meet design criteria. Although Mobil has continued to use bare tubing and bare tubing-packer type completion designs, their consideration of the above and other pertinent factors has led to the frequent use of insulated tubulars. Current plans call for the continued use and testing of these tubulars, along with future field testing of completion variations designed to reduce overall operating costs. 7 refs., 5 figs.

35725 (CU/FCE–8903, pp. 16) **In situ oil sands temperature logging.** Leshchyshyn, T. (Petro-Canada Inc., Canada); Seyer, W. Calgary Univ., AB (Canada). Faculty of Continuing Education. 1989. (CONF-8903126–: 6. annual heavy oil and oil sands technical symposium, Calgary, Canada, 8 Mar 1989;CE–02591). In *Challenges and innovations 1989. 6th Annual heavy oil and oil sands technical sypmposium.* Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

Temperature logging has been used extensively for in-situ oil sands operations to determine the vertical heat zone profile and the maximum temperature during cyclic steam production. Recurring inconsistencies from temperature logging at three single well cyclic steam tests in the McMurray oil sands initiated an investigation into the problems of temperature logging and the selection of possible solutions. The standard temperature logging techniques previously used were critically analyzed to determine the physical problems which can lead to erroneous results. Tool design, mainly the inability of the temperature probe to stabilize quickly, appeared to be the major reason cited for unreliable readings. The tool was modified and new data were obtained, showing much improved consistency. A practical stationary logging procedure was developed to identify potential temperature logging problems. 4 refs., 5 figs., 1 tab.

35726 (CU/FCE–8903, pp. 31) **Prevention of formation damage through injection and production practices in heavy oil reservoirs.** Coskuner, G. (Petroleum Recovery Inst., Canada); Maini, B.; George, A.E. Calgary Univ., AB (Canada). Faculty of Continuing Education. 1989. (CONF-8903126–: 6. annual heavy oil and oil sands technical symposium, Calgary, Canada, 8 Mar 1989;CE–02591). In *Challenges and innovations 1989. 6th Annual heavy oil and oil sands technical sypmposium.* Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

Most heavy oil reservoirs are situated in unconsolidated formations. These types of formations are sensitive to changes in in-situ stresses at the reservoir. That is, they expand greatly as the net confining pressure is decreased and this may cause changes in the properties of the formation. Formation damage is a frequently encountered phenomenon in heavy oil reservoirs. This paper describes the effect of net confining pressure on mechanical fines migration. Experiments show that the critical velocity at which fines start to disperse and permeability starts to decline decreases with increasing net confining pressure. Results are analyzed in the light of the fact

that the net confining pressure changes during injection and production. Furthermore, recommendations are made to minimize the rate damage during the field operations. 17 refs., 12 figs., 2 tabs.

35727 (CU/FCE–8903, pp. 24) **The Husky bi-provincial upgrader design basis.** Chase, S. (Husky Oil Operations Ltd.). Calgary Univ., AB (Canada). Faculty of Continuing Education. 1989. (CONF-8903126–: 6. annual heavy oil and oil sands technical symposium, Calgary, Canada, 8 Mar 1989;CE–02591). In *Challenges and innovations 1989. 6th Annual heavy oil and oil sands technical symposium.* Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

The bi-provincial upgrader complex is designed to produce 46,000 barrels per calendar day (BPCD) of synthetic crude and 8,000 BPCD of asphalt from 54,000 BPCD of a 65/35 volumetric blend of Lloydminster and Cold Lake heavy oils. The complex will consist of the existing Lloydminster refinery and the upgrader facility. The upgrader facility is a grassroots installation that will be located in Saskatchewan about 8 km from the existing refinery. The existing refinery is a 25,000 BPCD unit whose primary function is to produce asphalt from heavy oil. This refinery will continue to produce asphalt, naphtha (which is recycled to the production fields for use as a diluent) and a combined gas-oil stream. This gas-oil stream will by hydrotreated in the upgrader. In this paper, the process configuration and some of the more important considerations in the process design of the complex are reviewed. Also discussed are the properties of the heavy crude oil feedstocks, the primary synthetic crude quality targets, and the selection of the H-OIL process as the primary upgrading technology. The flowsheet of the process is presented: the primary upgrading plant (H-OIL unit, delayed coker, and gas recovery unit), the secondary upgrading (gas-oil hydrotreater, and naphtha jet hydrotreater), the hydrogen plant, the sulfur recovery plant, and the support systems. 2 figs., 4 tabs.

35728 (CU/FCE–8903, pp. 15) **The newGrade upgrader.** Court, A.L. (NewGrade Energy Inc., Canada); Smith, W.H. Calgary Univ., AB (Canada). Faculty of Continuing Education. 1989. (CONF-8903126–: 6. annual heavy oil and oil sands technical symposium, Calgary, Canada, 8 Mar 1989;CE–02591). In *Challenges and innovations 1989. 6th Annual heavy oil and oil sands technical symposium.* Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

In 1983, Consumers Co-operative Refineries Limited (CCRL), with the governments of Saskatchewan and Canada, undertook a study to establish the viability of upgrading Saskatchewan's large reserves of heavy oil, using CCRL's existing Regina refinery as a starting point. The decision to proceed with the design and construction of the facility was made in late 1985; field construction started in October 1986, and the complex processed its first heavy oil in November 1988. Process selection, hydrogen supply, and sulfur recovery are discussed. The final integrated refinery/upgrader complex has the capability to process 50,000 bbl/d of Lloydminster/Fosterton type crudes to produce a full range of petroleum fuel products and to blend a competitive synthetic crude oil for pipeline delivery. Engineering, procurement, and construction, all under a managing contractor, are discussed. It was decided that the new facility would be turned over from construction by systems. There have been a reasonable number of mechanical problems, most related to inadequate winterization. The project was completed on-schedule and on-budget in October 1988 for $700 M. The complex is now running completely on heavy crude oils at 80% of its design capacity and is expected to reach full capacity in the latter months of 1989. 1 fig., 1 tab

35729 (CU/FCE–8903, pp. 12) **OSLO project update and upgrader technology selection.** Dowdle, L.D. (Esso Resources Canada Ltd., Canada). Calgary Univ., AB (Canada). Faculty of Continuing Education. 1989. (CONF-8903126–: 6. annual heavy oil and oil sands technical symposium, Calgary, Canada, 8 Mar 1989;CE–02591). In *Challenges and innovations 1989. 6th Annual heavy oil and oil sands technical symposium.* Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

OSLO in an acronym for "other six leases operation", a six company joint venture formed in 1981 to explore for and develop oil sands resources on six leases in the Athabasca region of Alberta. Since its formation, OSLO has spent over $30 M on resource evaluation programs and a wide variety of studies. The search for resources has led to two very large, high quality bitumen ore bodies. Since 1985, the OSLO owners have focussed their efforts on the more favorable of the two, which has over 3 G bbl of high quality surface mineable bitumen. The development option selected has been a fully integrated 12,000 m^3 per calendar day synthetic crude oil project. The choice of the project size and configuration and its schedule are briefly discussed. The upgrading processing scheme represents one of the most complex components in a tar sands recovery plant. The two major steps are primary upgrading (conversion of the large bitumen molecules into smaller ones) and secondary upgrading (hydrotreating to remove sulfur and nitrogen). The choice of a preferred technology is briefly discussed, including the definition of the project issues, the evaluation of available technologies (in particular, their environmental impacts), licensor business proposals, economics, and risk assessment. 5 figs.

35730 (RPC–420301) **Modifications of existing testing facilities, optimization of hydroretorting conditions, and assessment of Canadian oil shales as source of synthetic fuels. Final report.** Research and Productivity Council, NB (Canada). 1983. 140p. (MICROLOG–89-01951). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A test facility previously developed at the Research and Productivity Council (RPC) of Canada for retorting oil shales under hydrogen pressures was modified to improve oil recoveries. The hydroretorting conditions were optimized at 500 psi hydrogen, 700^{0}C, and 8^{0}C/min heat-up rate using a Kentucky oil shale sample previously evaluated at the Institute of Gas Technology (IGT), Chicago, Illinois. Oil quantities recovered from the RPC facility were comparable to results from IGT. The optimized conditions for the Kentucky oil shale were used to evaluate a total of 37 oil shale samples from New Brunswick, Ontario, Nova Scotia, Newfoundland, British Columbia, and Quebec. Hydrogen retorting increased the oil yields from 6% to greater than 150% over Fischer assay. Organic conversion rates were also increased under hydrogen retorting for all shale samples tested. The highest grades of oil shale tested were from Albert County, New Brunswick. The average oil yields for five New Brunswick samples increased from 20.0 gal/ton for nitrogen retorting to 38.4 gal/ton for hydroretorting. 3 refs., 63 figs., 13 tabs.

35731 (UCID–16986-89-1) **Lawrence Livermore National Laboratory oil shale quarterly report, January–March 1989.** Cena, R.J. (ed.). Lawrence Livermore National Lab., CA (USA). May 1989. 12p. Sponsored by DOE Fossil Energy. DOE Contract W-7405-ENG-48. Order Number DE89014301/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Obtaining accurate kinetics of oil generation and associated oil degradation reactions is an important part of understanding and improving oil shale pyrolysis processes. While programmed micropyrolysis at several heating rates offers one method for measuring chemical kinetics data, an alternative that is rapid and potentially more accurate (e.g., in relating the kinetics to a specific temperature or temperature range) is the use of an isothermal fluidized bed. A principal hindrance in interpreting fluidized-bed data is that the signal being measured can undergo significant delay and dispersion from the time it is generated until it reaches the detector. The measured reaction rate can be significantly different from the true rate. Meaningless kinetic parameters can be obtained by ignoring those differences. A tracer signal measured under the same conditions will help quantify the dispersion. We have modified our kinetic analysis program, KINETICS, to make use of tracer data by means of the latter procedure. 2 refs., 6 figs., 2 tabs.

0405 Properties and Composition

Refer also to citation(s) 35716, 35717, 35718, 37132

35732 (AOSTRA–8808, pp. 8) **Practical applications of X-radiography techniques in tar sands.** Savoie, C.L. (Western Atlas Canada Ltd., Calgary, AB, Canada). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Radiographic tecniques are used to identify physical core characteristics before the core is slabbed and/or sampled. In the case of a tar sand well, it is most important to locate the low density reservoir sand (consolidated or unconsolidated) and the higher density, potential permeability barriers such as shale, siltstone and tight sandstone, since it is the nature, thickness and distribution of these various components which can dictate whether a well is suitable for production. This paper describes a method by which a tar sand core can be interpreted using X-radiography, and outlines the advantages of X-raying a total well. 7 refs., 6 tabs.

35733 (AOSTRA–8808, pp. 10) **Comparative study of organic rich solids present in Utah and Athabasca oil sands.** Kotlyar, L.S. (National Research Council of Canada, Ottawa, ON, Canada); Ripmeester, J.A.; Sparks, B.D.; Kodama, H. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The presence of humic matter modifies the hydrophilic character of some oil sands solids surfaces and thereby results in serious problems in bitumen recovery using water based processes. In this work, the fraction enriched with humic matter was separated from the bulk of Utah oil sand solids, using the cold water agitation test, and characterized by different techniques. The results obtained were discussed in comparison with those for Athabasca samples of different geological origin. By means of solid state ^{13}C NMR, it was demonstrated that the humic matter present in the separated solids is predominantly aliphatic in nature, with the aromaticity much lower, compared to that for Athabasca humic matter. These results suggest that in the case of Utah samples terrestrial input into the formation of humic material is not as significant as it is for Athabasca oil sands. The main inorganic components of the solids separated from Utah oil sand were iron-bearing x-ray amorphous material (possibly iron oxide), and also calcite and dolomite. The distribution of organic and carbonate as well as amorphous matter among size fractions derived from Utah fine (fraction $<38\ \mu$), both before and after the cold water agitation test treatment, were studied. It is suggested that, similar to Athabasca oil sands, humic matter in Utah samples occurs in association with x-ray amorphous inorganic components. As in the case of Athabasca samples of marine origin, these organic rich solids are important in the formation and stabilization of hydrophobic globules that have high affinity to bitumen and therefore adversely affect bitumen separability. 31 refs., 4 figs., 5 tabs.

35734 (AOSTRA–8808, pp. 12) **Regional characterization of geomechanical properties of unconsolidated sands of the heavy oil belt, Venezuela.** Rajani, B. (Petroleos de Venezuela S.A., Caracas, Venezuela); Sanchez, M. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The Orinoco heavy oil sands are at a relative shallow depth of less than 1500m. Since the porosity of these oil sands is in the 30 to 42% range and because they are compressible, it is expected that, due to oil production, the sands are susceptible to compaction, therefore inducing a beneficial production mechanism. Nevertheless, this could cause undesirable surface subsidence. As a result, a concerted effort has been made to determine the geomechanical properties (uniaxial compressibility, stress history, and permeability) of a large number of samples from the Zuata, Hamaca, and Cerro Negro areas. Overconsolidation ratio and vertical strain corresponding to the vertical effective stress are identified as being good indicators of disturbance. If the data from disturbed samples are discarded, then it is possible to evaluate uniaxial compressibilities that define a characteristic behavior for the whole region. The rate of compaction should be low in the initial stages of production in the area. The absolute permeability-porosity relationship based on core samples of the unconsolidated sands is also characteristic over the region. This has been described by a quadratic semi-logarithmic relation. Since the porosities of the samples do not truly represent the in situ values, a methodology is required to integrate core permeability-porosity measurements in the laboratory with in situ porosities. 6 refs., 7 figs., 1 tab.

35735 (AOSTRA–8808, pp. 14) **Shear dilatency and permeability enhancement in oil sands.** Dusseault, M.B. (Univ. of Waterloo, Waterloo, ON, Canada); Rothenburg, L. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The constitutive model of soils being developed in this paper is based on a precise statement of the behavior of clastic assemblies. Strain-induced anistropy is accommodated by a statement of current fabric and an evolutionary law that stipulates how this fabric evolves. Pore pressure distribution, dilative behavior, and effects on stress states require appropriate boundary conditions, changes thereto, and material laws. In particular, this paper seeks to elucidate the fabric-permeability-dilation relationships and their effect on mechanical behavior as explicit functions of stress state and strain history. Initial conditions required include the current fabric state tensor and the stress tensor for particular field cases. A constitutive statement for oil sands can be derived by laboratory tests, as oil sands can be considered homogeneous and without discontinuities. Data on water permeability as related to shear distortion and dilation are required, as this controls pore pressure evolution in situ. The difficulty in obtaining truly undisturbed specimens remains a barrier to these tasks, but improvements are being made. Field verification is necessary to test predictions and map deviations from predictions. Monitoring must go beyond pressure-volume-temperature measurements. 15 refs., 12 figs.

35736 (CU/FCE–8903, pp. 10) **Jet cracking. A novel coke free visbreaking process.** Chakma, A. (Univ. of Calgary, Calgary, AB, Canada); Chornet, E.; Overend, R.P.; Dawson, W.H. Calgary Univ., AB (Canada). Faculty of Continuing Education. 1989. (CONF-8903126–: 6. annual heavy oil and oil sands technical symposium, Calgary, Canada, 8 Mar 1989;CE–02591). In *Challenges and innovations 1989. 6th Annual heavy oil and oil sands technical symposium.* Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

A novel visbreaking process suitable for viscosity reduction of Alberta bitumens is described. This process uses a high shear jet reactor consisting of a high pressure stainless steel vessel equipped with a specially designed pressure nozzle and is based on the concept of destruction of the micellar structure of asphaltenes, which are responsible for the high viscosity of Alberta bitumens. This destruction is carried out by imparting high shear forces in the presence of thermal disorder. Hot H_2 or N_2 and Athabasca Coker Feed Bitumen were passed through a specially designed mixture and nozzle set-up, simultaneously. Due to the high shear imparted to the bitumen during its passage through the nozzle, asphaltene aggregates were broken. In addition, very fine bitumen droplets were produced, which resulted in intimate mixing of the gas and the liquid. Bitumen viscosity was reduced from 70,000 centipoises measured at 20^0C to below 200 centipoises under mild operating conditions, i.e. 3.5 megapascals at 420^0C. Due to very short residence time inside the reactor, coke formation was almost entirely

avoided. The attractive features of this process are as follows: no catalyst requirement, low pressure operation, little coke formation, and a compact, single reactor suitable for field operation. A patent application has now been filed for this process. 2 refs., 1 fig., 1 tab.

0406 Direct Uses and By-products

Refer also to citation(s) 35716

0408 Marketing and Economics

Refer also to citation(s) 35645, 35646, 35703

35737 (AOSTRA–8808, pp. 7) **Positive effects of the bemolanga tar sands exploitation.** Ratsimandresy, R. (Office Militaire National pour les Industries Strategigues (OMNIS), Antananarivo, Madagascar); Raveloson, E.; Rako-Andriantsilavo, M.D. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Madagascar has been until now an oil importing country. To address this situation, the Malagasy Government intends to exploit the Bemolanga Tar Sands, which could contribute to the economic development of the country and to its energy self-sufficiency. The importation of petroleum products is a great burden on the country's budget, and the substitution of those products with the synthetic crude from tar sand would allow savings of foreign currency. In order to appraise the opportunity of the exploitation of the Bemolanga Tar Sands, this paper deals with the situation of needs in petroleum products and the economic effects expected from the tar sands exploitation. The realization of the project presents some restrictions. At the production unit level, the high investments influence considerably the financial profitability of the project. To make the project acceptable, the cost price of synthetic crude produced should be about $17 US per barrel and its selling price between $22 and $25 US per barrel. At the national economy level, with the production price up to $25 US per barrel, including 15% of financial interest, the project is still profitable for Madagasgar because it contributes to the country's economic growth, but beyond this price, it would be a great charge for the consumers. According to the rate of return and expected economic effects, the Bemolanga Tar Sand exploitation can be considered an economically viable project. 5 refs., 7 tabs.

0409 Waste Research and Management

35738 (AOSTRA–8808, pp. 16) **The development of shear strength in sludge/clay shale mixes for oil sands tailings disposal.** Dusseault, M.B (Univ. of Waterloo, Waterloo, ON, Canada); Scott, J.D.; Ash, P.O. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The availability of overburden, mature sludge, and sand in open pit oil sand mining operations opens novel options for permanent waste disposal, yielding a material that is more easily reclaimed. In the Athabasca Deposit, where oil is extracted using hot-water processes, tailings are pipelined to ponds where 50% of the fines flow into the pond and consolidate into mature sludge, ca 35% solids by weight. This consolidates so slowly that it will have to reside permanently in ponds. Overburden is mainly overconsolidated smectitic clay shale with a large suction potential. Combining these materials may eliminate liquid wastes and facilitate reclamation, and there are other possible benefits in transportation. Test programs addressed moisture transfer rates from sludge to overconsolidated clay shale, effects of salinity and solids content on water transfer, and undrained strength of shale-sludge mixes. Laboratory blended waste strength seems adequate for stacking and reclamation, and water transfer is slow enough that slurry pipelining may be viable. It is concluded that addition of low moisture content fines can mitigate hot water extraction waste problems. 26 refs., 14 figs., 4 tabs.

35739 (AOSTRA–8808, pp. 11) **Hydrogeological and geochemical criteria for assessing sites of subsurface injection of EOR waste water in the Cold Lake area, Alberta, Canada.** Perkins, E. (Alberta Research Council, Edmonton, AB, Canada); Bachu, S.; Hitchon, B. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Prediction of the fate and transport of liquid waste waters from Enhanced Oil Recovery (EOR) operations injected into deep aquifers in the Cold Lake area is critical for the selection of the three-dimensional position of safe injection zones because the hydrogeological and geochemical environments of these zones ultimately control the movement of the injected liquids. Therefore, a predictive assessment requires a regional analysis of the baseline conditions prior to commencement of injection. Ideally, the host aquifer should be thick, extensive and sufficiently porous and permeable to accept the rates injected at pressures that preclude the onset of hydraulic fracturing, and should not be more valuable for other uses. Overlying and underlying strata should be sufficiently thick, extensive and hydraulically strong to avoid leakage outside the injection aquifer. Adverse water-rock interactions should be avoided. Finally, the injection zone should not contain solution-collapse features, faults, extensive natural fractures, or unplugged or improperly plugged abandoned wells. This paper presents selected results of a study which specifically modelled the predicted effects of EOR waste water injection for a period of 30 y at multiple sites in the Cooking Lake, Mannville, McMurray and Clearwater Formations and into the Basal Cambrian sandstone in the Cold Lake area of Alberta. These examples illustrate how various criteria are considered for selecting injection aquifers in cases where the wealth of hydrogeological information permits detailed analysis of the hydrostratigraphy, of the natural flow regime in the multilayered system, and of the response of the system to sustained injections rates. 6 refs., 4 figs., 1 tab.

35740 (AOSTRA–8808, pp. 6) **Electrocoagulation of tar sand tailings pond waters.** Renk, R.R (Western Research Inst., Laramie, WY, USA). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Tar sand processing wastewaters from Syncrude Canada and other commercial and experimental operations were treated with a new electrocoagulation process that uses electrical current to destabilize and remove dissolved and suspended materials. The purpose of the treatment is to produce a low-cost, environmentally acceptable water for storage, reuse, or discharge. Bench-scale tests indicate an operating cost of around $0.03/m^3. Materials removed from the wastewater include dissolved and suspended materials, both organic and inorganic. The electrocoagulation processes removed 99% of the total suspended solids; 65% to 95% of the dissolved (0.45 um filtered) silica, calcium, and magnesium, and 50% to 95% of the total organic carbon. Microtox tests indicated a moderate reduction in toxicity after electrocoagulation. Electrocoagulation may provide an inexpensive way of separating solids from tailings. The water could then be stored, discharged, or reused, and the solids could be handled separately in a relatively dry form, thus potentially eliminating the need for large tailings ponds. 2 refs., 4 tabs.

0410 Environmental Aspects

35741 (AOSTRA–8808, pp. 5) **Environmental mediation in major oil sands developments. An alternative model to resolution of native, corporate and government interests in resource development approval processes.** Slavik, J.N. (Ackroyd, Piasta, Lennie, Edmonton, AB, Canada); Wallace, R.; Boucher, J. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The potential use of a mediation process to resolve the conflicts between oil sands developers and Native peoples in northeastern Alberta has recently been explored by the Alberta Energy Resources Conservation Board (ERCB). This paper reports on the successful completion of such a process by the Fort McKay Indian Band and Syncrude Canada, Ltd., with the co-operation and participation of the ERCB, Alberta Environment, and associated interests. In 1985, in an attempt to identify and resolve concerns that had previously been expressed by the Indian Band, and thereby to avoid the need for a public hearing, the Syncrude Application Review Group (SARG) was established. This procedure successfully resolved many outstanding environmental and socio-economic problems long pursued by the Band through the traditional hearings process in Alberta. A subsequent process, the Syncrude Expansion Review Group, was also initiated after the successful conclusion of the SARG mediation and it, too, successfully resolved many outstanding problems. The advantages and disadvantages of this type of mediation are explored with a view to reaching broad conclusions applicable to other development applications elsewhere. 6 refs.

0420 Regulations

35742 (AOSTRA–8808, pp. 10) **Onshore federal reservoir management program and the relationship to heavy crude and tar sands in California.** Moore, T. (Bureau of Land Management); Wilkerson, G. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The oil and gas mineral resources of the United States have been managed through public laws and administrative agencies since 1846. Administrative reorganizations within the Department of the Interior made in 1982 led to the establishment of two agencies for hydrocarbon reservoir management: the Minerals Management Service (MMS), responsible for offshore reservoir management and royalty accounting, and the Bureau of Land Management (BLM), which administers the onshore reservoir management program. Continuing legislative enactments have given MMS and BLM guidance for the administration of the exploration and development of heavy crude and tar sand deposits. The Combined Hydrocarbon Leasing Act of 1981 established a means of leasing tar sands in special areas all which occur outside California. A federal all-competitive leasing system was adopted in 1987 for the onshore hydrocarbon mineral estate. This legislation applies to heavy crude oil, but not to tar sands or oil shale. In 1988, a new drainage manual was drafted to help support the Drainage Protection Program, whose goal is to protect federal mineral resources from loss of royalties through off-lease drainage. Federal lessees must protect the federal mineral resource from drainage by either paying a compensatory royalty, drilling a protective well, or relinquishing their lease. There is currently no leasing program for tar sand in the USA. Heavy crude is leased under the conventional oil and gas leasing laws. The Metson Pool in Kern County is discussed as an example of enhanced recovery by steam injection. Statistics of heavy oil production in California are given. 8 refs., 4 figs., 3 tabs.

35743 (AOSTRA–8808, pp. 6) **Oil sands project application. Review process-mediation, not confrontation.** Evans, R.G. (Energy Resources Conservation Board, Calgary, AB, Canada). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The Energy Resources Conservation Board (ERCB) in Alberta has the responsibility of receiving applications for the development of energy projects in Alberta, and of granting approvals where warranted. Because of the quasi-judicial mandate under which the ERCB operates, any outside party that may be directly and adversely affected by a decision of the Board must be given an opportunity to know about and make representation regarding the application. Often a public hearing process has been used for this purpose. In many instances, however, it has been apparent that neither the information disssemination function nor the dispute resolution function was satisfactorily served by the hearing process. Thus, in several major oil sands projects in the past three years, the ERCB has utilized an alternative to the hearing process that is designed to provide maximum opportunity for information exchange on energy project applications, provide a less formal venue for discussing and resolving concerns or problems with the project, and give the various parties an opportunity to reach a reasonable compromise between their various economic, environmental, and social impact concerns. This paper describes the mediation process that has been used successfully in several instances, outlines the methodology and advantages of the process, and suggests some guidelines or limitations that may apply to its use. This process has been successful in developing effective communication channels between major oil sands developers and the local community, and also in resolving controversial issues between those parties.

35744 (AOSTRA–8808, pp. 7) **New oil sands conservation regulations for Alberta.** Evans, R.G (Energy Resources Conservation Board, Calgary, AB, Canada); Mayer, W.A. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

In February 1984, the Provincial Legislature of Alberta proclaimed the new Oil Sands Conservation Act, which consolidated the rules empowering the Energy Resources Conservation Board (ERCB) to regulate and monitor the development of its major hydrocarbon resource. Until recently, the rules for oil sands development in Alberta were borrowed from regulations developed for the conventional oil and gas industry and applied to in situ oil sands projects, or from the coal industry and applied to surface mining projects. In those cases where neither of these regulatory regimes was applicable, regulation was achieved by the ERCB through special conditions attached to operating approvals granted by the ERCB. In an attempt to simplify and consolidate these rules, and to tailor them more specifically to the oil sands industry and its unique circumstances, a new set of regulations has been promulgated. Following several years of careful drafting, an extensive consultation process was carried out that involved the ERCB, Alberta government departments, and a number of industry groups representing both the in situ and the oil sands mining project operators. In a number of aspects, the new regulations differ from those previously applied. This paper describes the organization and format of the new regulations, highlights those areas that are new or different in nature, and points out those areas where simplifications or efficiencies have been achieved.

05 NUCLEAR FUELS

35745 (WHC-SA–0581) **ASTM C-26 committee and standards development.** Delvin, W.L. Westinghouse Hanford Co., Richland, WA (USA). May 1989. 6p. Sponsored by DOE Defense

Programs. DOE Contract AC06-87RL10930. (CONF-890736–2: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, Florida, USA, 9-12 Jul 1989). Order Number DE89013533/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The C-26 Committee on Nuclear Fuel Cycle (C-26) is a typical ASTM committee organized to meet a specific need within the nuclear industry. This committee promotes knowledge and the development of standards for nuclear fuel cycle products, processes, and a variety of materials associated with those products and processes. The committee currently has 14 active subcommittees, most of which have responsibility for developing standards. Standards are developed, prepared, and published through a well-defined process established by ASTM and used by all ASTM committees. That process ensures consensus between various interests through a rigorously followed balloting procedure. The organization and work of C-26, particularly as they relate to safeguards, is briefly described in this paper. In addition, the standard process used by C-26, which is the basic ASTM process, is discussed. 5 refs.

35746 Managing hazards and evaluating safety in nuclear facilities. Russcher, G.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). v. of Probabilistic safety assessment and risk management PSA '87. Vol. 3. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). DOE Contract AC06-76RL01830. (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

An assessment of potential hazards associated with operating a nuclear facility was used to appraise the safety system of the facility. First, a list of credible hazards representing potential energy sources was developed through use of a preliminary hazard analysis. Then, a team of technical and management staff members used a weighted selection process to develop a list of postulated accident scenarios for in-depth evaluation during a facility safety appraisal. During the appraisal, six major functional areas of the facility's safety system were reviewed to determine whether it was effectively controlling the hazards or precluding the postulated accidents.

0501 Reserves, Exploration, and Mining

Refer also to citation(s) 35833, 35835

35747 (CNIC–00214) **Metallogenetic condition and mineralization characteristics of uranium deposit No.114.** Niu Lin; Ma Fei; Yang Wanjin. China Nuclear Information Centre, Beijing, BJ (China). 1988. 16p. (In Chinese). (BUGRI–0003). Order Number DE89613485/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Deposit No 114 is one of the typical carbonate-type uranium deposits, that are widely distributed in South China. In this paper formational environment of host rock, wall-rock alteration, sulfur, oxygen, carbon isotopes, mineralization temperatures, ore compsitions were studied. Based on the U-Pb isotopic research three mineralization stages in deposit No 114 were established, namely 104 Ma, 61 Ma and 11 Ma. It is suggested, that the deposit No 114 is a polygenetic deposit formed primarily by supergene leaching and hydrothermal reworked. The uranium deposit has multi-sources, the main uranium source of which is from the granite body situated nearby. According to metallogenetic characteristics the authors suggest the favourable geological exploration guides for this kind of ore deposits.

35748 (INIS-mf–11457(v.1,2) v. 1) **Randomization of grab sample strategies for estimating the exposure of uranium miners to radon daughters.** Borak, T.B. (Colorado State Univ., Fort Collins (USA). Dept. of Radiology and Radiation Biology). Canadian Nuclear Association, Toronto, ON (Canada). 1985. (CONF-841016–: International conference on occupational radiation safety in mining, Toronto, Ontario, Canada, 15-18 Oct 1984). In *Occupational radiation safety in mining. Proceedings of the international conference (in two volumes).* Order Number DE89619926/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

In most underground uranium mines in the U.S.A., the integrated annual exposure to radon daughters is determined by combining periodic grab samples of working level with time of occupancy. This can lead to considerable uncertainties. One important consideration is the systematic bias introduced if the grab samples are taken the same time each day or during periods immediately following the repair of a faulty ventilation system. Procedures that randomize the time between measurements for each location are discussed. Complete randomization of all measurement times is often not feasibile due to manpower and fiscal considerations. Methods that compromise true randomization without introducing bias have been investigated. 6 figures, 1 table.

35749 (INIS-mf–11457(v.1,2) v. 1) **Dynamic approach to the implementation of the optimization principles in uranium mines.** Fourcade, N. (Centre d'Etude sur l'Evaluation de la Protection dans le Domaine Nucleaire, 92 - Fontenay-aux-Roses (France)); Zettwoog, P. Canadian Nuclear Association, Toronto, ON (Canada). 1985. (CONF-841016–: International conference on occupational radiation safety in mining, Toronto, Ontario, Canada, 15-18 Oct 1984). In *Occupational radiation safety in mining. Proceedings of the international conference (in two volumes).* Order Number DE89619926/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

This report presents the status of our considerations on the methodology for implementing the optimization principle in uranium mines, and the consequences that we draw in terms of occupational safety. No measures are planned concerning operating methods, job organization, or compliance with internal operational recommendations. (3 tables, 5 figures).

35750 (INIS-mf–11457(v.1,2) v. 1) **Characterization of radioactive long-lived dust present in uranium mines and mills atmospheres.** Duport, P.J. (Canadian Inst. for Radiation Safety, Elliot Lake, ON (Canada)); Edwardson, E. Canadian Nuclear Association, Toronto, ON (Canada). 1985. (CONF-841016–: International conference on occupational radiation safety in mining, Toronto, Ontario, Canada, 15-18 Oct 1984). In *Occupational radiation safety in mining. Proceedings of the international conference (in two volumes).* Order Number DE89619926/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The physical characteristics of alpha-emitting long-lived dust were investigated in uranium mines and mills. The MMAD and AMAD were generally within the range of 2 to 10 μm with standard geometirc deviations between 3 and 5. Radon emanation rates from uranium bearing particles is about 30%. The activity air concentration of alpha emitting dust ranges from 10 to 700 mBq/m^3 in underground locations and from 10 to 2000 mBq/m^3 in mills.

35751 (INIS-mf–11457(v.1,2) v. 1) **Recreating the uranium mining environment of the 1950's.** Scott, A.G. (DSMA Atcon Ltd., Toronto, ON (Canada)). Canadian Nuclear Association, Toronto, ON (Canada). 1985. (CONF-841016–: International conference on occupational radiation safety in mining, Toronto, Ontario, Canada, 15-18 Oct 1984). In *Occupational radiation safety in mining. Proceedings of the international conference (in two volumes).* Order Number DE89619926/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

A picture of uranium mining practices at Elliot Lake in the late 1950's was built up from interviews with old miners and a review of contemporary literature. These practices were simulated at a pilot raise in an operating uranium mine. Extensive measurements were made of the resulting radiological conditions, which were similar to those reported in the 1950's. A general computer model of airborne concentrations versus ventilation was calibrated with the measurements, and used to estimate changes in miner exposure from the 1950's to today.

35752 (INIS-mf–11457(v.1,2) v. 1) **Radon emanation at the Mullenbach research uranium mine and its effects on ventilation planning.** Reim, K. (Saarberg-Interplan Uran GmbH, Saarbrucken (Germany, F.R.)); Thome, M.; Haupt, W. Canadian Nuclear Association, Toronto, ON (Canada). 1985. (CONF-841016–: International conference on occupational radiation safety in mining, Toronto, Ontario, Canada, 15-18 Oct 1984). In *Occupational radiation safety in mining. Proceedings of the international conference (in two volumes).* Order Number DE89619926/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Experiments carried out at the Mullenbach test mine indicate that the air quantity prescribed by the German mining law for mechanized uranium mines is more than adequate to control radon daughters to within 4 WLM per year. Sealing of rock surfaces, application of positive ventilation pressure, watering down of blasted rock and variations in blasting techniques have a limited influence on the radon exhalation rate. In first approximation the radon exhalation of a future uranium mine can be estimated from drill cores recovered during the exploration stage. This assists the mining engineer in calculating the air requirements for a future mine.

0504 Feed Processing

Refer also to citation(s) 37198

35753 (CNIC–00147) **Investigation of hydrofluorination reactivity on denitrated uranium oxides.** Li Panyu; Feng Jiawu. China Nuclear Information Centre, Beijing, BJ (China). Jan 1988. 5p. (In Chinese). (SOF–202-001). Order Number DE89613219/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The simultaneous reduction-hydrofluorination of dioxide, mixed oxide and trioxide of uranium prepared in fluidized bed denitration with hydrogen reduction is introduced. A method was proposed, which improves the reactivity of denitration products in hydrofluorination with ammonia reduction so that a high grade uranium tetrafluoride can be produced. The experimental results showed that a high grade uranium tetrafluoride can be prepared if the denitrated mixed uranium oxides producted by one and half step method were used. In certain conditions, this method may also improve the reactivity of uranium dioxid produced by one step denitration-reduction.

35754 (FMPC–2174) **Implementing requirements for radiation worker training from DOE Order 5480.11.** Fitzgerald, R.J. Westinghouse Materials Co. of Ohio, Cincinnati, OH (USA). Feed Materials Production Center. 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract AC05-86OR21600. (CONF-8905155–1: Radiation protection workshop, Chicago, IL, USA, 16-17 May 1989). Order Number DE89013259/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

At the Feed Materials Production Center operated by Westinghouse Materials Company of Ohio, we have already initiated classroom training to implement the new requirements for Radiation Worker Training from DOE Order 5480.11. Those requirements include a variety of subjects.

0505 Uranium Enrichment

Refer also to citation(s) 35777, 35828, 35842, 37198

0507 Fuels Production and Properties

Refer also to citation(s) 36136, 36614, 36717, 36718, 36719, 36825, 37602, 37603, 37604, 37606, 37625, 37634

35755 (CONF-890470– IV.A.1.1-IV.A.1.8) **Relating quality at work to quality at home.** Hajek, B.K.; Puffenberger, S.F.; Billings, H.C. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

INPO 87-004 details specific topics to be covered in General Employee Training. At Boston Edison, these topics were combined with Company commitments and policies, and a belief that by relating the importance of quality concerns to each worker's daily lives, the application of Quality Assurance and Quality Control practices at Pilgrim Station could be enhanced. It was decided that if a commitment to quality was to be instilled in each worker, a high quality General Employee Training program should set the example. This commitment to quality was implemented using a fast paced, multi-image technique with a high quality visual and audio presentation format. The program was designed so that a minimum of changes would be needed over its life. The program's success has been proven since its installation in 1986. During updates to the Pilgrim General Employee Training Program since that time, no programming changes have been needed in the Quality Assurance module.

35756 (LA-UR–89-2151) **Unattended mode operation of specialized NDA [nondestructive assay] systems.** Klosterbuer, S.F.; Kern, E.A.; Painter, J.A.; Takahashi, S. Los Alamos National Lab., NM (USA). 1989. 6p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890736–23: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, FL, USA, 9-12 Jul 1989). Order Number DE89014287/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

Nondestructive assay systems have been developed to allow data acquisition equipment to operate unattended in an automated mixed oxide facility, reducing inspector time in a facility and giving them time for other activities. Fewer inspector visits mean less impact on plant operators. Neutron detectors are located at key measurement points in the facility. Near each detector is located an electronics cabinet, which contains two JSR-11 shift registers, two COMPAQ Portable III computers, and a printer. The signal from the detector is split and sent to each shift register for redundancy and reliability. The software for unattended operation consists primarily of two programs, COLLECT and REVIEW. The COLLECT program runs on the computers in unattended operation; shift-register data are acquired each 60 s. The COLLECT program distinguishes between a normal background and a disconnected signal, between material moving near the detector and material in the detector, and whether the material in the detector is a sample or a californium normalization source. Depending on the type of assay, different data are stored on the hard disk. During an inspection, the inspector stops the current measurement campaign, examines the data from both computers briefly at the electronics cabinet, copies the campaign data to floppy disk, and starts another measurement campaign. These data are examined later in another location using the REVIEW program running on high performance microcomputers: a COMPAQ DeskPro 386/20 or equivalent. The REVIEW program uses graphical displays to enable the inspector to quickly search through the massive amounts of accumulated data to learn when samples were measured. Data from the desired measurements are then transferred to the International Atomic Energy Agency high-level neutron coincidence program for further analysis. 3 refs., 7 figs.

35757 (LA-UR–89-2152) **Remote-controlled NDA [nondestructive assay] systems for feed and product storage at an automated MOX [mixed oxide] facility.** Menlove, H.O.; Augustson, R.H.; Ohtani, T.; Seya, M.; Takahashi, S.; Abedin-Zadeh, R.; Hassan, B.; Napoli, S. Los Alamos National Lab., NM (USA). 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890736–24: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, FL, USA, 9-12 Jul 1989). Order Number DE89014286/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Nondestructive assay (NDA) systems have been developed for use in an automated mixed oxide (MOX) fabrication facility. Unique features have been developed for the NDA systems to accommodate robotic sample handling and remote operation. In addition, the systems have been designed to obtain International Atomic Energy Agency inspection data without the need for an inspector at the facility at the time of the measurements. The equipment is being designed to operate continuously in an unattended mode with data storage for periods of up to one month. The two systems described in this paper include a canister counter for the assay of MOX powder at the input to the facility and a capsule counter for the assay of complete liquid-metal fast breeder reactor fuel assemblies at the output of the plant. The design, performance characteristics, and authentication of the two systems will be described. The data related to reliability, precision, and stability will be presented. 5 refs., 10 figs., 4 tabs.

35758 (RFP–4207) **Electrorefining cell evaluation.** Bronson, M.C.; Thomas, R.L. (ed.). Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant. 14 Apr 1989. 26p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP03533. Order Number DE89014388/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Operational characteristics of the LANL electrorefining cell, a modified LANL electrorefining cell, and an advanced electrorefining cell (known as the CRAC cell) were determined. Average process yields achieved were: 75% for the LANL cell, 82% for the modified LANL cell, and 86% for the CRAC cell. All product metal from the LANL and modified LANL cells was within foundry specifications. Metal from one run in the CRAC cell exceeded foundry specifications for tantalum. The LANL and modified LANL cells were simple in design and operation, but product separation was more labor intensive than with the CRAC cell. The CRAC cell was more complicated in design but remained relatively simple in operation. A decision analysis concluded that the modified LANL cell was the preferred cell. It was recommended that the modified LANL cell be implemented by the Plutonium Recovery Project at Rocky Flats and that development of the CRAC cell continue. 8 refs., 22 figs., 12 tabs.

35759 (WHC-SA–0471) **Fast Flux Test Facility metal fuel pin fabrication.** Benecke, M.W.; Dittmer, J.O.; Feigenbutz, L.V. Westinghouse Hanford Co., Richland, WA (USA). May 1989. 15p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-890604–6: Annual meeting of the American Nuclear Society, Atlanta, GA, USA, 4-8 Jun 1989). Order Number DE89013531/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

A new initiative to develop, irradiate, and qualify a binary uranium/zirconium metal fuel system in the Fast Flux Test Facility (FFTF) has been implemented by the Westinghouse Hanford Company for the US Department of Energy. Metal fuel test assemblies have been designed and fabricated and are now being irradiated in FFTF to provide the data needed to support the potential use of binary fuels in FFTF and other liquid metal reactors. These development efforts support licensing activities for metal fuel use in near-term advanced liquid metal reactors. New metal fuel pin design features, fabrication development, and fabrication processes for three metal fuel tests will be described and their irradiation status reported in this paper. 11 figs.

35760 (Y/TR–89/5) **Process and preparation facility for uranium tetrafluoride.** Petit, J. Oak Ridge National Lab., TN (USA). 1989. 16p. Translated from European Patent Application 0 295 999 A1, May 31, 1988. Sponsored by DOE Defense Programs. DOE Contract AC05-84OS21400. Order Number DE89014852/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this invention is a process for the preparation of uranium tetrafluoride, an intermediate product widely used in the nuclear industry, from uranyl nitrate, a form through which new uranium or uranium from fuel reprocessing necessarily goes in practice. The process according to the invention is characterized by including the following steps: catalytic reduction by hydrogen, in the presence of H+ ions, of a solution of a soluble uranium salt (VI) in a solution of a soluble uranium salt (IV); reaction of the uranium (IV) salt obtained in the preceding step with hydrofluoric acid in order to obtain precipitation of the uranium tetrafluoride; and recovery of said uranium tetrafluoride in the form of a precipitate or an evaporate. 1 fig.

35761 (Y/TR–89/6) **Process and preparation facility for double uranium fluoride.** Petit, J. Oak Ridge National Lab., TN (USA). [1989]. 21p. Translation from the French Patent Application 0 295 998 A1, May 31, 1988. Sponsored by DOE Defense Programs. DOE Contract AC05-84OS21400. Order Number DE89014853/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of the invention is a process for preparing double fluoride of uranium and of an alkaline or alkaline-earth metal (ammonium being considered as an alkaline metal), from uranyl nitrate, the form to which new uranium or uranium from fuel reprocessing necessarily passes in practice. The process according to the invention is characterized by including the following steps: catalytic reduction by hydrogen, in the presence of H+ ions, of a solution of a soluble uranium salt (VI) in a solution of a soluble uranium salt (IV); reaction of the uranium (IV) salt obtained in the preceding step with fluoride ions, in the presence of ammonium, alkaline or alkaline-earth ions, to obtain precipitation of the double uranium and ammonium or alkaline metal or alkaline-earth fluoride; and recovery of the double fluoride in the form of a precipitate. 1 fig.

35762 **Separation potential of solvent extraction in the recovery of metals.** Kolarik, Z. (National Lab., Argonne, IL (US)). v.v of Chemical separations. King, J.C.; Navratil, J.D. Litarvin Literature, Arvada, CO (1986). (CONF-860411–: 1. international conference on separations science and technology, New York, New York, USA, 15-17 Apr 1986).

Solvent extraction can be applied to the recovery of metals from source materials as different as intermediate products like leach liquors (recovery of copper, nickel, cobalt, etc.), commercial products like wet-process phosphoric acid (recovery of uranium), and waste products like irradiated nuclear fuels (recovery of uranium and plutonium). Examples are given of extraction systems, in which the required selectivity and efficiency of the extraction of a particular metal are reached by a proper choice of the solvent and of the ionic medium. Extractants of all common types (i.e., acidic, basic or neutral compounds) and also different extractant combinations can be used as active components of the solvent. Possible improvements and future trends of extraction processes are discussed.

0508 Spent Fuels Reprocessing

Refer also to citation(s) 35758, 35760, 35761

35763 (CONF-890753–1) **Simulation of a continuous rotary dissolver.** Carnal, C.L.; Hardy, J.E.; Lewis, B.E. Oak Ridge National Lab., TN (USA). 1989. 21p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. From Summer computer simulation conference; Austin, Texas, USA; 24-27 Jul 1989. Order Number DE89009114/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes the simulation of a rotating, multistage chemical reactor that dissolves spent nuclear fuel for reprocessing in a breeder cycle. The continuous, time-dependent process model of a dissolver was developed using the Advanced Continuous Simulation Language (ACSL) to calculate various temperatures and the masses of the chemical constituents of the solution in each stage. The Gear integration algorithm (Gear 1971) was used to accommodate the stiff dynamics. An arrangement of interacting discrete sections was employed to cause fresh fuel to be added and dissolver rotations to occur at appropriate times. By changing various constants, the model can simulate the effect of different fuel compositions and operational scenarios. The model code is a valuable tool for analysis of the performance of the dissolution system and has been instrumental in its design. 5 refs., 7 figs.

35764 (INIS-SU–97, pp. 25-30) **Multifunctional organophosphorus extractants: a status report on development and applications.** Schulz, W.W. (Westinghouse Hanford Co., Richland, WA (USA)); Horwitz, E.P. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Up-to-date state of the development of science and technology of multifunctional organophosphorus extractants is considered. The detailed classification of these extractants is presented. They attracted pasticular interest because of affinity of some bifunctional phosphonates, phosphine oxides, carbamoylalkylphosphonates to trivalent Am, tetravalent and hexavalent actinides, trivalent lanthanides in strong mineral acids, and because of ability of some alkylpyrophosphoric acids to extract effectively U(4) from concentrated solutions of phosphoric acid. Application of these extractants for analytic purposes and in the field of nuclear technology is considered. 6 refs.; 3 tabs.

35765 (INIS-SU–97, pp. 154-157) **Study of salting effect of D2EHPA in chloride solutions.** Jiufang Lu (Tsinghua Univ., Beijing, BJ (China)); Yigui Li; Hongbing Ding; Teng Teng. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Solubility of D2EHPA in pure water (S_0=87.0 mg/l) and in aqueous solutions of alkali metal and ammonium chlorides and hydrochloric acid was measured. It was shown that salt addition to

aqueous solutions up to 3-5 M concentration caused the decrease of D2EHPA solubility according to Setschenow equation. The observed salting effect was explained from the viewpoint of electrostatic theory, the internal pressure theory, the scaled particle theory, Pitzer theory. 6 refs.; 3 tabs.

35766 (ORNL/FTR–3304) **[Analytical chemistry in nuclear technology, Karlsruhe, Germany and visit to Selbersdorf, Austria, June 3–22, 1989]: Foreign trip report.** Klatt, L.N. Oak Ridge National Lab., TN (USA). 5 Jul 1989. 13p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014873/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Papers presented at the Second Karlsruhe International Conference on Analytical Chemistry in Nuclear Technology addressed topics in new developments in analytical methods, uranium and plutonium analysis, in-line, automated and non-destructive analysis, surface analysis, analysis for impurities and degradation products, trace analysis of radionuclides in the environment, and safeguards. Among the invited lectures, those addressing the political facts and fictions surrounding plutonium as a nuclear fuel, the status of in-line instrumentation in the reprocessing industry, techniques to reduce the amount of waste generated by the reprocessing plant support laboratory, and safeguard analysis needs for the large capacity reprocessing plants were particularly noteworthy. A successful and extended demonstration of in-line electrochemical measurement of aqueous plutonium concentration in a reprocessing plant was reported. In-line spectrophotometry developments at the Kernforschungszentrum Karlsruhe, Institut fuer Radiochemie are summarized.

0509 Transport and Storage

Refer also to citation(s) 35654, 35770

35767 (EPRI-NP–6425) **Design considerations for on-site spent-fuel transfer systems: Final report.** Jones, R.H.; Jones, C.R. Electric Power Research Inst., Palo Alto, CA (USA); Levy (S.), Inc., Campbell, CA (USA). c Jun 1989. 60p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Studies on spent fuel shipping logistics and operation make it clear that the use of large casks, i.e., 100–125 tons, is superior to smaller casks of similar construction. This superiority manifests itself in both transportation and/or shipping economics and safety as well as reduced personnel exposure in the processing of the casks. An on-site system for the transfer of spent fuel from the storage pool to a large shipping or storage cask, as well as the transfer of spent fuel directly from a storage cask to a shipping cask, could bring the large cask benefits to those restricted reactors. Sensing the need to look more closely at this opportunity, EPRI contracted with S. Levy, Incorporated of Campbell, CA to develop a set of design considerations for such transfer systems. Rather then embark on another design study, EPRI decided to first identify the system considerations that must be factored into any design. The format for this effort presents both the Consideration and the Rationale for the consideration. The resulting work identified thirty-six General Considerations and two Special Considerations. The Considerations are in the form of mandatory requirements and desirable but nonmandatory requirements. Additionally, a brief economic study was performed to get a feel for the cost considerations of on-site transfers. The study results suggest a relatively narrow set of scenarios where on-site transfers are economically superior to alternatives. These scenarios generally involve the use of concrete casks as on-site storage devices.

35768 (LA–11517-M) **HEU [highly enriched uranium] drum monitor manual (for confirmatory measurements).** Sprinkle, J.K. Jr.; Stovall, L.A. Los Alamos National Lab., NM (USA). Jun 1989. 61p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE89014386/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This manual describes the operation of the highly enriched uranium (HEU) drum monitor. The drum monitor measures the passive gamma-ray emissions from a sealed shipping container of HEU. These emissions are from ^{235}U and from daughters of ^{238}U. These radiations span a wide range of energy; consequently, each is susceptible to attenuation and shielding to a different degree. The combination of these measured gamma-ray rates with a weight measurement provides a unique signature for each item. These unique signatures can be determined with similar instruments at both ends of a material transfer between Department of Energy facilities. A consistent result from the two instruments indicates material control has been achieved, specifically that no material was lost or diverted. An additional objective of this instrument is to separate the material control issue from the measurement control issue. This is achieved by not calibrating the instrument and by reporting count rates instead of masses. Consequently, the results do not include calibration uncertainties, and therefore they are more precise. In addition, there are no sampling errors. A signal unique to the special nuclear material (SNM) is obtained nondestructively from the entire item. This instrument complements traditional containment and surveillance techniques by providing a precise measurement of an attribute unique to the SNM in the sample. 4 refs., 6 figs.

35769 (POEF-T–3504) **A review of the Model 5A uranium hexafluoride cylinder.** Dorning, R.E. II. Martin Marietta Energy Systems, Inc., Portsmouth, OH (USA). Quality and Technical Services Div. 23 May 1989. 20p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-76OR00001. Order Number DE89014432/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Both the Model 5A (Monel 400) and 5A (Monel 400) Modified five-inch cylinders have been used at the Portsmouth GDP to withdraw, store, and ship highly enriched uranium hexafluoride. As a result of a generic cracking problem with Monel 400 valve-boss material, a cylinder modification was implemented in the mid 1970s. This modification resulted in the violation of the ASME "Code" stamp status of the Model 5A Modified cylinder. Hydrostatic testing-to- rupture data indicated that the Model 5A Modified cylinders had ruptured strengths equivalent to that of the original Model 5A cylinders. An independent consultant reviewed the available information and confirmed that the Model 5A Modified cylinders "will with proper maintenance continue to perform satisfactorily for many additional years of service." Based on the test data and consultant's review, DOE approved continued use of the 5A Modified cylinder and also requested procurement of replacement 5B cylinders be expedited. Currently, the 5A modified cylinders are in the production, storage, shipment cycle, and a sufficient number of 5B cylinders has been ordered to accommodate the projected product shipping requirements for the Navy flow. 3 tabs.

0520 Waste Management

Refer also to citation(s) 36888, 37200, 37201, 37202, 37224, 37403, 37414

35770 (CFFTP-G–87013) **Conditioning and handling of tritiated wastes at Canadian nuclear power facilities.** Krochmalnek, L.S.; Krasznai, J.P.; Carney, M. Canadian Fusion Fuels Technology Project, Toronto, ON (Canada). Apr 1987. 12p. (CONF-870410–: 193. national meeting of the American Chemical Society, Denver, Colorado, USA, 5-10 Apr 1987). Order Number DE89620093/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Ontario Hydro operates a 10,000 MW capacity nuclear power system utilizing the CANDU pressurized heavy water reactor design. The use of D_2O as moderator and coolant results in the production of about 2400 Ci of tritium per MWe-yr. As a result, there is significant Canadian experience in the treatment, handling, transport and storage of tritiated wastes. Ontario Hydro operates its own reactor waste storage site which includes systems for volume reduction, immobilization and packaging of wastes. In addition, a facility to remove tritium from heavy water is presently being commissioned at the Darlington nuclear site. This facility will generate tritiated liquid and solid waste that will have to be properly conditioned prior to storage or disposal. The nature of these various wastes and the processes/packaging required to meet storage/disposal criteria are judged to have relevance to investigations in fusion facility waste arisings. Experience to date, planned operational procedures and ongoing R and D in this area are described.

35771 (CONF-881054–Vol.1) **1988 DOE model conference proceedings: Volume 1.** Analysas Corp., Oak Ridge, TN (USA). 1988. 366p. Sponsored by DOE Defense Programs. DOE Contract AC05-84OR21400. From 4. annual DOE model conference; Oak Ridge, TN, USA; 3-7 Oct 1988. Order Number DE89014700/JAW. Available from NTIS, PC A15/MF A01 - OSTI; GPO Dep.

These Proceedings of the October 3-7, 1988, DOE Model Conference are a compilation of the papers that were presented in the technical or poster sessions at the conference. Papers and posters not submitted for publication are not included in the Proceedings. The Table of Contents lists the titles of papers as well as the names of the presenters. These individuals are not, in all cases, the primary authors of the papers published. The actual title pages, appearing later with the papers, show the primary author(s) and all co-authors. The papers in all three volumes of the Proceedings appear as they were originally submitted for publication and have not been edited or changed in any way. Topics included in Volume 1 are Environmental Data Management, Site characterization technology, Wastewater treatment, Waste management in foreign countries, Transuranic waste management, and Groundwater characterization and treatment.

35772 (CONF-881054–Vol.2) **1988 DOE model conference proceedings: Volume 2.** Martin Marietta Energy Systems, Inc., Oak Ridge, TN (USA); Analysas Corp., Oak Ridge, TN (USA). 1988. 292p. Sponsored by DOE Defense Programs. DOE Contract AC05-84OR21400. From 4. annual DOE model conference; Oak Ridge, Tennessee, USA; 3-7 Oct 1988. Order Number DE89014701/JAW. Available from NTIS, PC A13/MF A01 - OSTI; GPO Dep.

These Proceedings of the October 3 - 7, 1988, DOE Model Conference are a compilation of the papers that were presented in the technical or poster sessions at the conference. Papers and posters not submitted for publication are not included in the proceedings. The Table of Contents lists the titles of papers as well as the names of the presenters. These individuals are not, in all cases, the primary authors of the papers published. The actual title pages, appearing later with the papers, show the primary author(s) and all co-authors. The papers in all three volumes of the Proceedings appear as they were originally submitted for publication and have not been edited or changed in any way. Volume 2 contains information on environmental restoration at federal facilities, waste disposal technology, quality assurance, contingency planning and emergency response, decontamination and decommissioning, environmental restoration, and public involvement in waste management.

35773 (CONF-881054–Vol.3) **1988 DOE model conference proceedings: Volume 3.** Martin Marietta Energy Systems, Inc., Oak Ridge, TN (USA); Analysas Corp., Oak Ridge, TN (USA). 1988. 310p. Sponsored by DOE Defense Programs. DOE Contract AC05-84OR21400. From 4. annual DOE model conference; Oak Ridge, Tennessee, USA; 3-7 Oct 1988. Order Number DE89014702/JAW. Available from NTIS, PC A14/MF A01 - OSTI; GPO Dep.

These Proceedings of the October 3 - 7, 1988, DOE Model Conference are a compilation of the papers that were presented in the technical or poster sessions at the conference. Papers and posters not submitted for publication are not included in the Proceedings. The Table of Contents lists the titles of papers as well as the names of the presenters. These individuals are not, in all cases, the primary authors of the papers published. The actual title pages, appearing later with the papers, show the primary author(s) and all co-authors. The papers in all three volumes of the proceedings appear as they were originally submitted for publication and have not been edited or changed in any way. Topics included in Volume 3 include treatment of soils, waste characterization and certification, waste minimization site remediation management plans and programs, and training programs.

35774 (CONF-881054–Vol.4) **1988 DOE model conference proceedings: Volume 4.** Analysas Corp., Oak Ridge, TN (USA). 1988. 338p. Sponsored by DOE Defense Programs. DOE Contract AC05-84OR21400. From 4. annual DOE model conference; Oak Ridge, Tennessee, USA; 3-7 Oct 1988. Order Number DE89014703/JAW. Available from NTIS, PC A15/MF A01 - OSTI; GPO Dep.

These Proceedings of the October 3-7, 1988, DOE Model Conference are a compilation of the papers that were presented in the technical or poster sessions at the conference. Papers and posters not submitted for publication are not included in the Proceedings. The Table of Contents lists the titles of papers as well as the names of the presenters. These individuals are not, in all cases, the primary authors of the papers published. The actual title pages, appearing later with the papers, show the primary author(s) and all co-authors. The papers in all three volumes of the Proceedings appear as they were originally submitted for publication and have not been edited or changed in any way. Topics discussed in Volume 4 include site characterization and remediation projects, environmental monitoring and modeling; disposal site selection and facility design, risk assessment, safety and health issues, and site remediation technology.

35775 (CONF-881054–Vol.5) **1988 DOE model conference proceedings: Volume 5.** Martin Marietta Energy Systems, Inc., Oak Ridge, TN (USA); Analysas Corp., Oak Ridge, TN (USA). 1988. 290p. Sponsored by DOE Defense Programs. DOE Contract AC05-84OR21400. From 4. annual DOE model conference; Oak Ridge, Tennessee, USA; 3-7 Oct 1988. Order Number DE89014704/JAW. Available from NTIS, PC A13/MF A01 - OSTI; GPO Dep.

These Proceedings of the October 3–7, 1988 DOE Model Conference are a compilation of the papers that were presented in the technical or poster sessions at the conference papers and posters not submitted for publication are not included in the Proceedings. The Table of Contents lists the titles of papers as well as the names of the presenters. These individuals are not, in all cases, the primary authors of the papers published. The actual title pages, appearing later with the papers, show the primary author(s) and all co-authors. The papers in all three volumes of the Proceedings appear as they were originally submitted for publication and have not been edited or changed in any way. Topics discussed in Volume 5 include environmental assessments and program strategies, waste treatment technologies, and regulations and compliance studies.

35776 (CONF-890470– VI.B.4.1-VI.B.4.14) **Effective transition from panel board to CRT-based process control.** Mayfield, N.E. (Westinghouse Hanford Co., Richland, WA (USA)); Baynes, P.A. Oak Ridge National Lab., TN (USA). Apr 1989. DOE Contract AC06-87RL10930. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Nuclear process operators have controlled process operations using panel-board mounted instrumentation (PBMI) at Hanford since 1943. The decision was made to upgrade the B Plant Defense Waste Processing facility to state-of-the-art CRT-based process control, commonly referred to as a distributive control system (DCS) to improve operations safety, plant efficiency, and product quality. The safe and effective transition from PBMI to a DCS was the result of a cooperative effort between engineering, operations, and training, with full plant management support. Many elements of the upgrade had to be addressed: operator apprehension, vendor courses for the instructor and engineers, training interface with engineering and procurement, closed-loop communications, and structured implementation. Plant management considers this project a model example of effective implementation of new technology. This was a proactive and cooperative approach on a major facility upgrade. All too often training is left out of the planning stages on such projects. This more often than not creates reactive and unproductive training responses because of a lack of technical expertise and program development time. Other nuclear processing facilities are or will be facing this challenge. This paper presents the challenges and successes encountered during the transition to CRT-based process control. The intent of this presentation is to better prepare other training organizations for this type of transition.

35777 (CONF-890601–1) **Monitoring of corrosion in ORGDP cylinder yards.** Henson, H.M.; Barlow, C.R.; Frazier, J.L.; Ziehlke, K.T. Oak Ridge National Lab., TN (USA). 1989. 9p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. From Packaging and transportation of radioactive materials: PATRAM '89; Arlington, VA, USA; 11-16 Jun 1989. Order Number DE89014080/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Uranium hexafluoride (UF_6) throughout the nuclear fuel cycle is handled and stored in cylinders which are designed, manufactured, and maintained in accordance with the ASME Boiler and Pressure Vessel Code for unfired pressure vessels (Section VIII). There are presently more than 40,000 of these cylinders within the DOE Oak Ridge Operations complex currently used for the storage of isotopically depleted material (process tailings). These tails cylinders, in 10- and 14-ton sizes, are 48 inches in diameter and were originally constructed of steel ASTM A285, then since 1978 of steel ASTM A516. The corrosion and monitoring of corrosion of the cylinders is discussed. 8 refs., 6 figs.

35778 (CONF-890721–21) **Radioactive materials packaging standards and regulations: Making sense of it all.** Pope, R.B.; Rawl, R.R. Oak Ridge National Lab., TN (USA). 1989. 9p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. From Joint ASME/JSME pressure vessel and piping conference; Honolulu, Hawaii, USA; 23-27 Jul 1989. Order Number DE89010171/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

Numerous regulations and standards, both national and international, apply to the packaging and transportation of radioactive material. These are legal and technical prerequisites to practically every action that a designer or user of a radioactive material transportation package will perform. The identity and applicability of these requirements and the bodies that formulate them are also not readily understood. This paper addresses the roles that various international bodies play in developing and implementing the various regulations and standards. It uses the US regulatory and standards-making bodies to illustrate how international requirements feed the domestic control of packaging and transport. It explains the scope and interactions between domestic and international regulatory and standards agencies and summarizes the status and major standards activities at the international level. The overview provided by this paper will be valuable to designers and users of radioactive material packages for better understanding and use of both standards and regulations, and for complying with regulatory requirements in the radioactive materials transportation field. 11 refs., 2 figs.

35779 (CONF-8904232–1) **Methodology for hazardous waste surveys.** Chiu, S.; Martino, L. Argonne National Lab., IL (USA). 1989. 16p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Pacific basin conference on hazardous waste; Singapore, China; 2-7 Apr 1989. Order Number DE89013171/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The effective regulation and management of hazardous waste requires fundamental information on the amount, location, and source of the wastes as well as the adequacy of current and future facilities for treatment, storage, and disposal. Surveys of industries that generate or manage hazardous waste are essential to the development of such information. This paper addresses several methodological issues related to hazardous waste surveys, proposes a method to identify and classify hazardous waste, and suggests methods to use when designing and conducting surveys to maximize the accuracy of the data being collected. 8 refs., 1 fig., 3 tabs.

35780 (DOE/NV/10384–26) **Nevada Test Site Radionuclide Inventory and Distribution Program: Report number 5: Areas 5, 11, 12, 15, 17, 18, 19, 25, 26, and 30.** McArthur, R.D.; Mead, S.W. Nevada Univ., Las Vegas, NV (USA). Water Resources Center. Jun 1989. 157p. Sponsored by DOE Defense Programs. DOE Contract AC08-85NV10384. Order Number DE89014524/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

Between 1981 and 1986, more than 8,000 in situ measurements of gamma-emitting radionuclides were made on the Nevada Test Site as part of the Radionuclide Inventory and Distribution Program. These measurements, along with additional information from aerial surveys and analysis of soil samples, were used to estimate total inventories and distributions of radionuclides of NTS origin in the surface soil. The project's results for Yucca Flat and six ground zeros in Areas 18 and 20 were published in four previous reports. This report presents the results from the rest of the contaminated areas on the NTS, including Plutonium Valley, Frenchman Flat, the Buggy site, test facilities in Areas 25 and 26, and Areas 17 and 18. It also gives the results of measurements in several relatively uncontaminated regions in Areas 12, 15, and 19 and along the Fortymile Canyon and Mid-Valley Roads. 20 refs., 82 figs., 22 tabs.

35781 (DOE/RW–88.061) **1987 United Kingdom radioactive waste inventory.** Electrowatt Engineering Services Ltd., Horsham (UK). Oct 1988. 328p. (UKN–54). Order Number DE89620341/JAW. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

This report describes the stocks of radioactive wastes in the United Kingdom, together with projections of future arisings. Operational and decommissioning wastes are considered for both committed and prospective plant. Arisings are from power reactors, commercial reprocessing, fuel manufacture, medical and industrial sources and research and development. Data are presented for the wastes in their raw form and as conditioned for disposal. The data which refer to the situation on 1.1.87 are shown by producer and globally, in summary tables. The information presented for each producer includes a description of the activities that generate the wastes and a discussion of how stocks and arisings may have changed from earlier predictions. This is supplemented by a stream by stream tabulation showing the waste type, volume, density, conditioning factor and gross alpha and beta activity. The global projections are presented in tabular and graphical manner, and the changes from earlier projections are discussed. The scenarios which underly the projections are also presented.

35782 (DOE/RW–0225) **Quarterly report on program cost and schedule: First quarter FY 1989.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA). 1989. 37p. Sponsored by DOE Radioactive Waste Management. Available from OSTI.

This report is intended to provide a summary of the cost and schedule performance for the Civilian Radioactive Waste Management Program. Performance data are presented for each of the major program elements. Also included in this report is the status of the Nuclear Waste Fund revenues and disbursements. This report includes performance data through December 1988.

35783 (DOE/RW–0235) **MRS system study summary report.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA). Jun 1989. 149p. Sponsored by DOE Radioactive Waste Management. Available from OSTI.

The passage of the Nuclear Waste Policy Amendments Act (NWPAA) of 1987 prompted the Department of Energy (DOE) to reexamine the role of the monitored retrievable storage (MRS) facility in the waste- management system, and to this end a series of systems studies was conducted. The overall conclusion is that an MRS facility, whose principal function initially is to receive and store spent fuel, would enhance the waste-management system by providing early spent- fuel acceptance and flexibility for the system. However, these advantages would be gained at an increase in cost. The studies did not identify any significant benefit at present in either consolidating spent fuel or packaging it (encapsulating into disposal containers) at the MRS facility. The results of this study were used in developing the DOE's current position on the role of the MRS facility in the waste-management system.

35784 (DOE/SSDP–0062) **Shippingport Station Decommissioning Project preparation of the reactor pressure vessel: Topical report.** Westinghouse Hanford Co., Shippingport, PA (USA). 8 Jun 1989. 33p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-87RL10930. Order Number DE89014216/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This Topical Report is a synopsis of the preparation of the Reactor Pressure Vessel (RPV) at the Shippingport Station Decommissioning Project (SSDP). The information is provided as a part of the Technology Transfer Program to document the preparation activities in support of the one-piece removal and shipment of the RVP package. 6 refs., 7 figs., 2 tabs.

35785 (EPRI-NP–5675) **Below regulatory concern owners group: A general review of the IMPACTS-BRC Code: Final Report.** Kennedy, W.E., Jr.; Farris, W.T.; Baker, D.A.; Strenge, D.L.; Peloquin, R.A. Electric Power Research Inst., Palo Alto, CA (USA); Battelle Pacific Northwest Lab., Richland, WA (USA). c May 1989.

119p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC06-76RL01830. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The Electric Power Research Institute (EPRI) is conducting a project to develop support documentation for a rulemaking petition exempting specific nuclear power plant waste streams under the US Nuclear Regulatory Commission's (NRC) general Below Regulatory Concern (BRC) policy statement. In its policy statement, the NRC named the IMPACTS-BRC computer program as the primary compliance tool for granting exemptions. Because of this important role, EPRI authorized Battelle, Pacific Northwest Laboratories (BNW) to conduct a review of the computer program and its documentation. This report contains a summary of our general review of the IMPACTS-BRC computer program. In addition to reviewing the program and its supporting documentation, we conducted a performance evaluation and a sensitivity analysis of the operational software. The performance evaluation consisted of verifying the operation of the code, providing a general comparison of the results generated with results produced by other methods for similar input assumptions, and evaluating the Pathway Dose Conversion Factors (PDCFs) and Dose Conversion Factors (DCFs) used in the program. 21 refs., 13 figs., 25 tabs.

35786 (EPRI-NP–5679) **Below Regulatory Concern Owners Group: Assessment of the IMPACTS-BRC code: Final report.** Rogers, V.C.; Murphy, E.S. Electric Power Research Inst., Palo Alto, CA (USA); Rogers and Associates Engineering Corp., Salt Lake City, UT (USA). c May 1989. 103p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Electric Power Research Institute (EPRI) has initiated a special program effort for the development of a Nuclear Regulatory Commission (NRC) rulemaking petition to exempt certain very low activity nuclear power plant waste types as being Below Regulatory Concern (BRC). EPRI is to provide the technical research to support the BRC petition. One of the research tasks in the EPRI program entails a review and verification of the IMPACTS-BRC computer program used by NRC to independently evaluate individual and population radiological impacts from routine treatment and disposal of BRC wastes. A review of the IMPACTS-BRC computer program has been made to evaluate the sensitivity of the code to modeling assumptions and parameter values, assess conservatisms in the code, and verify that the code correctly performs the specified dose calculations. This report describes the results of this review. 6 refs., 3 figs., 13 tabs.

35787 (EPS–3/HA/3) **Removal of radium-226 from uranium mining effluents. Final report of a joint government-industry program.** Averill, D.W.; Moffett, D.; Webber, R.T.; Whittle, L.; Wood, J.A. Environment Canada, Ottawa, ON (Canada). Environmental Protection Service. Dec 1984. 41p. Order Number DE89620395/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Uranium mining and milling operations usually generate large quantities of solid and liquid waste materials. A slurry, consisting of waste rock and chemical solutions from the milling operation, is discharged to impoundment areas (tailings basins). Most of the radioactive material dissolved in tailings slurries is precipitated by the addition of lime and limestone prior to discharge from the mill. However, the activity of one radioisotope, radium-226, remains relatively high in the tailings basin effluents. In Canada, radium-226 is removed from uranium mining and milling effluents by the addition of barium chloride to precipitate barium-radium sulphate. Although dissolved radium-226 activities are generally reduced effectively, the process is considered to have two undesirable characteristics: the first related to suspended radium-226 in the effluents and the second to ultimate disposal of the $(Ba,Ra)SO_4$ sludge. A government-industry mining task force established a radioactivity sub-group in 1974 to assist in the development of effluent guidelines and regulations for the uranium mining industry. The investigation of more effective removal methods was recommended, including the development of mechanical treatment systems as alternatives to settling ponds. Environment Canada's Wastewater Technology Centre (WTC) initiated a bench scale study in March, 1976 which was designed to assess the feasibility of using precipitation, coagulation, flocculation and sedimentation for the removal of radium-226. In 1977, the study was accelerated with financial assistance from the Atomic Energy Control Board. Improved radium removals were obtained in bench scale batch tests using barium chloride as the precipitant and either alum or ferric chloride as the coagulant. A more comprehensive bench scale and pilot scale process development and demonstration program was formulated.

35788 (INIS-mf–11462) **Survey of radioactive waste disposal in Ireland.** O'Donovan, N.; Hone, C.; Turvey, F.J. Nuclear Energy Board, Dublin (Ireland). Dec 1988. 9p. Order Number DE89620407/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

This survey was undertaken by the Nuclear Energy Board (N.E.B) to assess the quantity of radioactive waste disposed of in Ireland and the methods used. The regulatory control of disposal is carried out on an ongoing basis by the Board's inspectors and is commented on routinely in the Board's annual report.

35789 (INIS-mf–11945) **Leaching of vitrified high-level-active-waste in a near reality simulated repository system. Final report.** Froeschen, W.; Wolf, G.K. Heidelberg Univ. (Germany, F.R.). Physikalisch-Chemisches Inst.; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). 1987. 58p. (In German). Order Number DE89788275/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

In the FRG it is planned to vitrify the high level waste from spent fuel reprocessing and to dispose of in a salt-mine. If water penetrates into the repository a highly corrosive brine (Q-brine) will be formed and radioactive material may be leached from the glasses and transported to human environment. The corrosion system of brine, corroded steel containers of the vitrified waste, and waste-glasses was investigated under near reality conditions. Experiments in hydrothermal environment were carried out including gamma radiation of the waste-glasses and ceramic In Can Lining between glasses and metallic containments. Screening experiments by application of external cobalt-gamma-radiation showed no principal changes in leaching behaviour of simulate glasses compared to leaching without radiation. Radiation effects result in pH changes mainly which are diminished by buffer capacity of Q-brine. Lining of steel containments with ceramic fleece does not reduce leaching but retards solution of Mo and Sr into brine. Decreasing of elements Sr, Cs and Mo in the near surface area of the glass and increasing of Zr and Ti has been found to be enhanced considerably in presence of canister corrosion products in Q-brine as well as in NaCl-leaching solution. (orig.) With 13 refs., 22 figs.

35790 (LA-UR–89-2066) **Development of neutron multiplicity counters for safeguards assay.** Ensslin, N. Los Alamos National Lab., NM (USA). 1989. 6p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890736–27: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, FL, USA, 9-12 Jul 1989). Order Number DE89014300/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper reports on the development of a new generation of neutron multiplicity counters for assaying impure plutonium. The new counters will be able to obtain three measured parameters from the neutron multiplicity distribution and will be able to determine sample mass, multiplication, and (α,n) reaction rate, making it possible to obtain a more matrix-independent assay of moist or impure materials. This paper describes the existing prototype multiplicity counters and evaluates their performance using assay variance as a figure of merit. The best performance to date is obtained with a high-efficiency, low die-away-time thermal neutron counter with shift-register electronics. 10 refs., 2 figs., 4 tabs.

35791 (NEI-SE–35) **Short summary of international workshop on principles for disposal of radioactive and other hazardous wastes, Stockholm 7-10 june 1988.** National Inst. of Radiation Protection, Stockholm (Sweden). 22 Jun 1988. 22p. (CONF-8806378–: International workshop on principles for disposal of radioactive and other hazardous wastes, Stockholm, Sweden, 7-10 Jun 1988). Order Number DE89618364/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The purpose of the workshop has been to discuss legal, scientific and practical aspects of disposal of low and intermediate level radioactive waste (LLW and ILW) and other types of hazardous wastes. During the autumn the National Institute of Radiation Protection will produce proceedings from the workshop. These proceedings will be published by the Department of Environment and Energy and will include opening addresses, invited paper, reports from discussions from plenary sessions as well as working groups and the recommendations agreed upon. In annexes will be found reports from the different working groups as well as the more interesting parts of the national presentations that served as discussion material for the different working groups.

35792 (NUREG/CR–4759) **Demonstration of a performance assessment methodology for high-level radioactive waste disposal in basalt formations.** Bonano, E.J.; Davis, P.A.; Shipers, L.R.; Brinster, K.F.; Beyler, W.E.; Updegraff, C.D.; Shepherd, E.R.; Tilton, L.M.; Wahi, K.K. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Sandia National Labs., Albuquerque, NM (USA). Jun 1989. 183p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (SAND–86-2325). Available from NTIS, PC A09/MF A01 - GPO - OSTI.

This document describes a performance assessment methodology developed for a high-level radioactive waste repository mined in deep basalt formations. This methodology is an extension of an earlier one applicable to bedded salt. The differences between the two methodologies arise primarily in the modeling of round-water flow and radionuclide transport. Bedded salt was assumed to be a porous medium, whereas basalt formations contain fractured zones. Therefore, mathematical models and associated computer codes were developed to simulate the aforementioned phenomena in fractured media. The use of the methodology is demonstrated at a hypothetical basalt site by analyzing seven scenarios: (1) thermohydrological effects caused by heat released from the repository, (2) mechanohydrological effects caused by an advancing and receding glacier, (3) normal ground-water flow, (4) pumping of ground water from a confined aquifer, (5) rerouting of a river near the repository, (6) drilling of a borehole through the repository, and (7) formation of a new fault intersecting the repository. The normal ground-water flow was considered the base-case scenario. This scenario was used to perform uncertainty and sensitivity analyses and to demonstrate the existing capabilities for assessing compliance with the ground-water travel time criterion and the containment requirements. Most of the other scenarios were considered perturbations of the base case, and a few were studied in terms of changes with respect to initial conditions. The potential impact of these scenarios on the long-term performance of the disposal system was ascertained through comparison with the base-case scenario or the undisturbed initial conditions. 66 refs., 106 figs., 27 tabs.

35793 (NUREG/CR–5352) **VAM2D–Variably saturated analysis model in two dimensions: Version 5.0 with hysteresis and chained decay transport: Documentation and user's guide.** Huyakorn, P.S.; Kool, J.B.; Robertson, J.B. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; HydroGeoLogic, Inc., Herndon, VA (USA). May 1989. 297p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A14/MF A01 - GPO - OSTI.

This report documents a two-dimensional finite element model, VAM2D, developed to simulate water flow and solute transport in variably saturated porous media. Both flow and transport simulation can be handled concurrently or sequentially. The formulation of the governing equations and the numerical procedures used in the code are presented. The flow equation is approximated using the Galerkin finite element method. Nonlinear soil moisture characteristics and atmospheric boundary conditions (e.g., infiltration and evaporation), are treated using Picard and Newton-Raphson iterations. Hysteresis effects and anisotropy in unsaturated hydraulic conductivity can be taken into account if needed. The contaminant transport simulation can account for advection, hydrodynamic dispersion, linear equilibrium sorption, and first-order degradation. Transport of a single component or a multi-component decay chain can be handled. The transport equation is approximated using an upstream weighted residual method. Several test problems are presented to verify the code and demonstrate its utility. These problems range from simple one-dimensional to complex two-dimensional and axisymmetric problems. This document has been produced as a user's manual. It contains detailed information on the code structure along with instructions for input data preparation and sample input and printed output for selected test problems. Also included are instructions for job set up and restarting procedures. 46 refs., 53 figs., 24 tabs.

35794 (NUREG/CR–5363) **A study of the use of crosslinked high-density polyethylene for low-level radioactive waste containers.** Soo, P.; Anderson, C.I.; Clinton, J.H. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Brookhaven National Lab., Upton, NY (USA). Jun 1989. 122p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (BNL-NUREG–52196). Available from NTIS, PC A07/MF A01 - GPO - OSTI.

A comprehensive research program has been completed to evaluate the effects of chemical and gamma-irradiation environments on the mechanical properties of crosslinked high-density polyethylene. The studies included uniaxial creep tests and crack initiation and crack propagation studies in statically-stressed U-bend samples. From the results obtained standard testing protocols were recommended for quantifying the various failure modes which could be present in this material during service as a low-level waste container. 24 refs., 66 figs., 20 tabs.

35795 (NUREG/CR–5389) **Analysis of alternative waste isolation concepts.** Christianson, M.C.; Brady, B. Nuclear Regulatory Commission, Washington, DC (USA). Div. of High-Level Waste Management; Itasca Consulting Group, Inc., Minneapolis, MN (USA). Jun 1989. 148p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A07/MF A01 - GPO - OSTI.

This report presents the results of a numerical analysis which compares the vertical and horizontal waste emplacement concepts currently under consideration for long-term nuclear waste storage. The two concepts are compared in terms of drift and borehole stability and compliance with the suggested design criteria. Thermal results are presented which illustrate the thermomechanical response of the rock adjacent to the emplacement drifts and boreholes. Mechanical results are presented which illustrate the stability of the emplacement rooms and boreholes as a result of in-situ and thermally-induced stresses. Conclusions include the finding that the horizontal waste emplacement geometry does not meet DOE's room temperature design criterion. It was also found that the horizontal emplacement drift is more sensitive to joint displacement than is the vertical emplacement drift. The boreholes used for horizontal emplacement are more sensitive to joint displacement than those for vertical emplacement. In both emplacement schemes, borehole stability will be a problem at the intersection of the borehole and emplacement drift. 25 refs., 54 figs., 5 tabs.

35796 (ORNL/FTR–2948) **Numerical modeling and tracer study of groundwater—Yenliao Nuclear Power Plant site, Taipei, Taiwan, June 5–12, 1988: Foreign trip report.** Yeh, G.T.; Solomon, D.K. Oak Ridge National Lab., TN (USA). 6 Jul 1988. 13p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014057/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The travelers attended a meeting held at TPC Headquarters in Taipei for two days. On the first day, the Interim Report I on numerical analysis of groundwater flow at a nuclear power plant site was the subject of extensive discussion. Conclusions and recommendations were formulated and agreed upon by TPC/National Taiwan University (NTU) investigators and ORNL staff. On the second day, the anticipated tracer experiment for determining contaminant transport parameters was discussed, and recommendations were made by ORNL staff.

35797 (ORNL/FTR–3300) **[Environmental assessment for radioactive waste disposal, Daeduk, South Korea, May 12–June 14, 1989]: Foreign trip report.** Lee, S.Y. Oak Ridge National Lab., TN (USA). 30 Jun 1989. 13p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89013269/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes the traveler's consulting activities for the Korea Advanced Energy Research Institute on its R and D projects for nuclear waste disposal. The traveler worked with staff scientists

and engineers on mineral characterization methodologies, adsorption study approaches and designs, and radionuclide migration pathway analyses and its associated problems. The travelers conducted four sessions of group discussion on (1) the selection of backfill materials, (2) experimental approaches of radionuclide transport in an engineered barrier and a near-field environment, (3) the mineralogical aspect of far-field radionuclide migration, and (4) experimental techniques for the measurement of radionuclide and geomedia interaction. 8 refs.

35798 (ORNL/Sub–88-21642/1) **Assessment of potential worker exposure for the Tumulus Disposal Demonstration Project: Fiscal year 1988 annual report.** Styers, D.R. Oak Ridge National Lab., TN (USA). Mar 1989. 67p. Sponsored by DOE Defense Programs. DOE Contract AC05-84OR21400. Order Number DE89013767/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The Tumulus Disposal Demonstration Project (TDDP) is evaluating the Tumulus technology for the disposal of solid low-level radioactive waste (LLW). The primary objective of the demonstration project is zero-release of radioactivity during the 100-year institutional control period of the facility. Radiological monitoring of the unit operations necessary for the preparation and placement of LLW onto the Tumulus pad was performed in order to determine the radiological exposures received by the workers as they disposed of this waste. These operations involved the placing of the primary waste containers into the secondary concrete disposal vaults, the grouting of these vaults, the sealing of the disposal containers, and the placing of the grouted vaults onto the Tumulus pad. Contact exposure rate measurements and transferable surface contamination levels were determined for the primary and secondary containers. The contact surface radiation levels were measured on all of the monitored primary waste disposal forms and had a dose equivalent rate of <200 mrem/hr (<2 mSv/hr).* This rate satisfies the requirement of the Waste Acceptance Criteria (WAC). 7 refs., 5 figs., 14 tabs.

35799 (PDER/BRP–9014198) **Appalachian States Compact Low-Level Radioactive Waste management survey, 1987.** Singh, K.N. Pennsylvania Dept. of Environmental Resources, Harrisburg, PA (USA). Bureau of Radiation Protection. Mar 1989. 125p. Order Number DE89014198/JAW. Available from NTIS, PC A06/MF A01 - OSTI.

Since the enactment of the Low-Level Radioactive Waste Disposal Act in February 1988, the Commonwealth of Pennsylvania has undertaken major steps to develop a Low-Level Radioactive Waste (LLRW) Disposal Facility within its borders for the exclusive use of radioactive material licensees in the Appalachian States Compact. In order to adequately plan for the design and development of that facility, it is essential to obtain accurate data on LLRW being generated in the Compact. To that end, the Division of Nuclear Safety of the Pennsylvania Bureau of Radiation Protection (BRP) conducted a survey to determine volume and activity of LLRW shipped and stored in 1987 by the licensees in the Appalachian States Compact. The 1986 LLRW survey included licensees in Pennsylvania and Maryland, while surveys conducted prior to 1986 involved only Pennsylvania licensees. So this is the first survey conducted by BRP that has included all four states of the Compact.

35800 (PNC-TN–8440-88-016) **Development of glass melter for the PNC Tokai Vitrification Facility.** Torata, Shin-ichiro; Sasaki, Noriaki; Horie, Misato; Tsunoda, Naomi. Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan). Oct 1988. 16p. Order Number DE89790902/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The development of the glass melter which will be used in the HLLW vitrification facility has been performed since 1977. The design and operational experiences has been accumulated through the process tests in the cold engineering facilities. The results obtained in these periods have been considered in the design of the Tokai Vitrification Facility (TVF), the construction of which has already been started in the spring of 1988. The present PNC melter system includes several features as the result of PNC's own improvements and modifications. The results of the melter development will be described in this paper mainly on the special features which are developed in PNC, such as glass fiber additives, induction-heated bottom drain nozzle and remote handling technique. The mock-up test using the new mock up melter which was constructed following the TVF final design has started to verify the process performance.

35801 (PNL–6821) **Regulatory requirements important to Hanford single-shell tank waste management decisions.** Keller, J.F.; Woodruff, M.G. Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 117p. Sponsored by DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE89014795/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report provides an initial analysis of the regulations that may be pertinent to SST management activities (e.g., characterization, disposal, retrieval, processing, etc.) and the interrelationships among those regulations. Waste disposal decisions regarding SST waste must consider the regulatory requirements against which technical solutions will be evaluated. Regulatory requirements can also be used as guidelines for management and disposal of waste in a manner that protects human health and safety and the environment. Also, in cases where waste management regulations do not specifically address a waste form, such as radioactive mixed waste, the SST waste may come under the purview of a number of regulations related to radioactive waste management, hazardous waste management, and water and air quality protection. This report provides a comprehensive review of the environmental pollution control and radioactive waste management statutes and regulations that are relevant to SST waste characterization and management. Also, other statutes and regulations that contain technical standards that may be used in the absence of directly applicable regulations are analyzed. 8 refs., 4 figs.

35802 (PNL–6882) **Technology assessment guide for application of engineered sorbent barriers to low-level radioactive waste disposal sites.** Freeman, H.D.; Jones, E.O.; Depner, J.P. Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 76p. Sponsored by DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE89014611/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

An engineered sorbent barrier (ESB) uses sorbent materials (such as activated carbon or natural zeolites) to restrict migration of radionuclides from low-level waste sites. The permeability of the ESB allows moisture to pass while the sorbent material traps or absorbs contaminants. In contrast, waste sites with impermeable barriers could fill with water, especially those waste sites in humid climates. A sorbent barrier can be a simple, effective, and inexpensive method for restricting radionuclide migration. This report provides information and references to be used in assessing the sorbent barrier technology for low-level waste disposal. The ESB assessment is based on sorbent material and soil properties, site conditions, and waste properties and inventories. These data are used to estimate the thickness of the barrier needed to meet all performance requirements for the waste site. This document addresses the following areas: (1) site information required to assess the need and overall performance of a sorbent barrier; (2) selection and testing of sorbent materials and underlying soils; (3) use of radionuclide transport models to estimate the required barrier thickness and long-term performance under a variety of site conditions; (4) general considerations for construction and quality assurance; and (5) cost estimates for applying the barrier. 37 refs., 6 figs., 2 tabs.

35803 (PNL–6898) **324 and 325 Building Hot Cell Cleanout Program: Air lock cover block refurbishment.** Katayama, Y.B.; Holton, L.K. Jr.; Gale, R.M. Pacific Northwest Lab., Richland, WA (USA). May 1989. 28p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE89014579/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The high-density concrete cover blocks shielding the pipe trench in the hot-cell air lock of the 324 Building Radiochemical Engineering Cells had accumulated fixed radioactivity ranging from 1100 to 22, 000 mrad/hr. A corresponding increase in the radiation exposure to personnel entering the air lock, together with ALARA concerns, led to the removal of the contaminated concrete surface with a hydraulic spaller and the emplacement of a stainless steel covering over a layer of grout. The resultant saving in radiation exposure is estimated to be 7200 mrad for personnel completing burial box runs for the 324 and 325 Building Hot Cell Cleanout Program. Radiation exposure to all staff members entering the air lock is now at least 50% lower. 3 refs., 22 figs., 1 tab.

35804 (PNL-SA-15641) **Treatment needs for Greater-Than-Class C low-level waste.** Ross, W.A.; Brouns, R.A.; Burkholder, H.C. Pacific Northwest Lab., Richland, WA (USA). Sep 1988. 7p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-880903-55: Spectrum '88: international topical meeting on nuclear and hazardous waste management, Pasco, WA, USA, 11-15 Sep 1988). Order Number DE89014436/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Greater-Than-Class C (GTCC) radioactive wastes are those low-level wastes that exceed the 10CFR61 limits for shallow-land burial but are not within the historical definition of high-level wastes (i.e., spent fuel and first-cycle reprocessing wastes). The GTCC category can include all transuranic (TRU) wastes, although for the purposes of this paper, contact-handled defense TRU wastes are excluded because of the major efforts in the past decade to prepare them for disposal at the Waste Isolation Pilot Plant (WIPP). Thus, the GTCC category includes all high-activity and remote-handled TRU wastes regardless of origin. This paper defines the need for treatment of existing and projected GTCC low-level radioactive wastes in the United States. The sources, characteristics, treatment considerations, and methods for treatment are reviewed. 10 refs., 1 fig., 2 tabs.

35805 (PNL-SA-16454) **An evaluation of near-field host rock temperatures for a spent fuel repository.** Altenhofen, M.K.; Lowery, P.S. Pacific Northwest Lab., Richland, WA (USA). Nov 1988. 16p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC06-76RL01830. (CONF-881143-7: American Institute of Chemical Engineers annual meeting, Washington, D.C., USA, 27 Nov - 2 dec 1988). Order Number DE89014462/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A repository heat transfer analysis has been performed by the Pacific Northwest Laboratory (PNL) for the US Department of Energy's Performance Assessment Scientific Support Program. The objective of this study was to evaluate the near-field thermal environmental conditions for a spent fuel repository system. A spent fuel logistics analysis was performed using a waste management system simulation model, WASTES-II, to evaluate the thermal characteristics of spent fuel received at the repository. A repository-scale thermal analysis was performed using a finite difference heat transfer code, TEMPEST, to evaluate the near-field host rock temperature. The calculated temporal and spatial distributions of near-field host rock temperatures provide input to the repository source term model in evaluations of engineered barrier system performance. 9 refs., 10 figs., 2 tabs.

35806 (PNL-SA-16743) **TRUEX process laboratory studies with Hanford complexant concentrate waste: Part 2, Test for solvent poisoning.** Swanson, J.L. Pacific Northwest Lab., Richland, WA (USA). May 1989. 8p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-8905122-7: 13. actinide separations conference, Idaho Falls, ID, USA, May 1989). Order Number DE89014461/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The TRUEX solvent extraction process, which has undergone extensive development at Argonne National Laboratory, is being considered for use in the processing of various wastes at Hanford. The objective of such processing would be to extract (and concentrate into a small volume of TRU waste) the contained plutonium and uranium so that the bulk of the waste can be treated as low-level waste. As part of their testing and evaluation of this process with actual wastes, Westinghouse Hanford Company (WHC) has asked the Pacific Northwest Laboratory (PNL) to perform tests to determine in a preliminary way if the wastes contain some material that was not encountered in the earlier studies and that might "poison" the solvent in some way, thereby making TRUEX processing difficult or very expensive. This report discusses the results obtained with complexant concentrate (CC) waste. This waste contains large quantities of organic complexing agents (e.g., EDTA, HEDTA) and organic acids (e.g., citric, tartaric), and/or degradation products of these materials, that were added to the waste during an earlier processing for the removal of strontium. It was thus thought to be a waste having a higher probability than most wastes of containing material that might have deleterious effects of TRUEX processing. 1 fig., 2 tabs.

35807 (SAND-88-0624) **Thermal-conductivity data for tuffs from the unsaturated zone at Yucca Mountain, Nevada: Yucca Mountain Project.** Nimick, F.B. Sandia National Labs., Albuquerque, NM (USA). Jun 1989. 85p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE89014594/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report is primarily a means of transmitting thermal-conductivity data to the Yucca Mountain Project properties data base. As such, the majority of the report is a compilation of these data for 45 samples of tuffaceous rocks from Yucca Mountain, Nevada; some of the data have been published previously. Brief discussions of the experiment technique (transient-line-source) and experiment uncertainties also are included. The accuracy of the thermal-conductivity data cannot be assessed at present; precision (repeatability) has been determined to be better than {+ }2%, in most cases. 15 refs., 5 figs., 1 tab.

35808 (SAND-88-2294) **A synopsis of analyses (1981-87) performed to assess the stability of underground excavations at Yucca Mountain: Yucca Mountain Project.** Ehgartner, B.L.; Kalinski, R.C. Sandia National Labs., Albuquerque, NM (USA). Dec 1988. 60p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE89014596/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This paper reviews 14 analyses that were performed by 10 different investigators during the course of 7 yr to assess the preclosure (up to 100 yr) stability of underground excavations for a potential nuclear waste repository located at Yucca Mountain, Nevada. The analyses were primarily based on thermomechanical models of the conceptual design of shafts and drifts. The material properties, codes, and design configurations used in the analyses varied because of the acquisition of additional data and refinement in codes and design over that period of time. However, all the analyses indicate that shafts and drifts can be constructed and will remain stable with minimum ground support through decommissioning of the repository. This information supports the feasibility of constructing a safe exploratory shaft facility and the expectation that it will remain stable should repository construction and waste emplacement follow. 63 refs., 2 tabs.

35809 (SAND-88-2785) **Preliminary analyses in support of in situ thermomechanical investigations.** Bauer, S.J.; Costin, L.S.; Holland, J.F. Sandia National Labs., Albuquerque, NM (USA). Dec 1988. 139p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE89014616/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The Yucca Mountain Project, managed by the Nevada Operations Office of the US Department of Energy, is examining the feasibility of siting a repository for high-level nuclear waste at Yucca Mountain on and adjacent to the Nevada Test Site. As part of the site characterization, a series of in situ thermomechanical experiments have been proposed, which are to be conducted in the exploratory shaft test facility. Three of the experiments, Canister-Scale Heater, Thermal Stress, and Heated Room, will provide some of the data required to (1) assess the thermomechanical response of tuff rock masses at several scales and (2) validate numerical models that may be used in the repository design process. In this report, the results of preliminary analyses of three in situ thermomechanical experiments are presented. The major objective of these analyses has been to provide some guidance to the experiment planners regarding the expected temperatures, displacements, and stresses with regard to time and position based on the very preliminary stage of the experiment design. The analyses will assist in selection and placement of instrumentation. Further, successful completion of these analyses demonstrates the ability to model the experiments, given the simplifying assumptions presented. Limitations of the analyses performed and the experiments as currently designed are also discussed. 13 refs., 72 figs., 4 tabs.

35810 (SAND-88-3352) **Waste Isolation Pilot Plant brine field pH measurements: Technique and interpretation.** Krumhansl, J.L. Sandia National Labs., Albuquerque, NM (USA). Jun 1989. 50p. Sponsored by DOE Radioactive Waste Management.

DOE Contract AC04-76DP00789. Order Number DE89014607/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

pH measurements made in conjunction with the Waste Isolation Pilot Plant Materials Interface Interactions Test (MIIT) are interpreted. The pH drop noted over time is correlated with other changes associated with MIIT brine evaporation. Magnesium buildup appears important, because a combination of high concentrations and elevated temperatures (about 90°C) can produce hydrochloric acid through hydrolysis of the magnesium ion, possibly explaining why the brines appeared to become more acid over time. For pH measurement techniques in concentrated brines, pH papers were useless in concentrated saline solutions. When traditional glass pH electrodes were substituted, other complications arose. For mildly acidic brines of known hydrogen ion concentration, the measured pH generally fell below the expected value. Also, the electrode responded differently to different salts. Magnesium chloride had a greater effect than sodium chloride, which in turn had a greater effect than potassium chloride. For nearly neutral brines, electrode drift became a serious problem, and when the meter finally stabilized, readings were significantly above those of the solutions from which the brines were prepared. The size of this positive deviation depended on the electrode being used and its previous conditioning. Both drift and the unusual high values were mitigated or eliminated in brines where a buffer was present in concentrations greater than about 0.001 molar. 22 refs., 11 figs., 9 tabs.

35811 (SAND–89-0462) **Systems analysis, long-term radionuclide transport, and dose assessments, Waste Isolation Pilot Plant (WIPP), southeastern New Mexico; March 1989.** Lappin, A.R.; Hunter, R.L.; Garber, D.P.; Davies, P.B. (eds.). Sandia National Labs., Albuquerque, NM (USA). Apr 1989. 671p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE89014586/JAW. Available from NTIS, PC A99/MF A01 - OSTI; GPO Dep.

This report summarizes the current understanding of the expected long-term behavior of the Waste Isolation Pilot Plant (WIPP) repository and estimates long-term radionuclide doses in a series of six analyses investigating both undisturbed repository (Case I) and performance in response to a relatively high-consequence human intrusion (Case II). It is the result of an intensive effort over a short time. The US Department of Energy (DOE) decided to have Sandia National Laboratories prepare this report as a result of a meeting held January 5, 1989. The conceptual model of the expected long-term behavior of the WIPP repository used in this report was formulated in early to mid January 1989, drawing and understanding developed over the past decade. Numerical modeling of ground-water flow, radionuclide transport, and doses to humans began January 20, 1989 and was completed March 20, 1989. 332 refs., 98 figs., 69 tabs.

35812 (WHC-EP–0165) **Westinghouse Hanford Company 100 Areas environmental releases for 1987.** Rokkan, D.J. Westinghouse Hanford Co., Richland, WA (USA). Jul 1988. 26p. Sponsored by DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE89014200/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Measured operational releases to the environment from Westinghouse Hanford 100 Areas facilities during calendar-year (CY) 1987 are reported. Radioanalyses of routine samples from radioactive liquid and airborne streams were performed using the Westinghouse Hanford 100-N Radioanalytical Laboratory and the analytical services of the US Testing Company located in Richland, Washington. Analyses of nonradioactive samples were performed in the laboratories of the Hanford Environmental Health Foundation. All releases were within N Reactor Technical Specification limits. The radioactive release from N Reactor exhibited no adverse trends during CY 1987. This was not unexpected because the reactor had an operating period of only 6.4 days. This shortness of operation was due to the extended "standdown" of the reactor. The standdown was an ordered shutdown for the purpose of implementing a series of upgrades to the safety systems of the reactor. The standdown began on January 7, 1987, and continued through the remainder of that year. Because of the extended length of the shutdown, the radiological and chemical releases in 1987, with one exception, are less than those in 1986. Hydrazine use increased in 1987 by 390% during the standdown because considerably more of this oxygen-scavenging chemical is required to control corrosion in the piping systems of the reactor when it is not operating. 5 refs., 13 figs., 17 tabs.

35813 (WHC-EP–0182-13) **Tank farm surveillance and waste status summary report for April 1989.** Thurman, J.M. Westinghouse Hanford Co., Richland, WA (USA). Jun 1989. 32p. Sponsored by DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE89014201/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report is Westinghouse Hanford Company's official inventory for high-level radioactive waste stored in underground tanks at the Hanford Site. Data that depict the status of stored, high-level waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 underground waste tanks, as well as to provide supplemental information regarding tank anomalies and ongoing investigations.

35814 (WHC-EP–0237) **Assessment of Basalt Waste Isolation Project's borehole mud pits soils and sediments for chemical constituents: Summary report.** Connelly, M.P.; Chou, C.J. Westinghouse Hanford Co., Richland, WA (USA). May 1989. 69p. Sponsored by DOE Environment Health & Safety. DOE Contract AC06-87RL10930. Order Number DE89014199/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

As part of an effort to characterize the geologic formations underlying the Hanford Site, 98 boreholes were drilled in support of the Basalt Waste Isolation Project. Review of drillings records indicated that certain drilling operations between 1973 and 1983 may have introduced hazardous substances into the environment. The suspected substances are constituents of drilling fluids that were channelled into pits adjacent to the drill sites. This report details operations at the seven boreholes determined to have the greatest potential for contamination. It also describes the study conducted to determine if hazardous chemicals are present, and if so identifies their concentrations and spatial distribution. The study was intended to provide input for decisions regarding remedial action. The data presorted herein were reviewed to the regulations of the Resource Conservation and Recovery Act of 1976. The findings are listed. The midputs are not considered dangerous according to the guidelines set by the Washington Department of Ecology. The pits do not require action under the provisions of the Resource Conservation and Recovery Act of 1976. The original borehole reclamation project will proceed as planned. 9 refs., 7 figs., 11 tabs.

35815 (WHC-EP–0275) **Liquid effluent study project plan.** Sommer, D.J.; Flyckt, D.L.; Johnson, V.G.; Law, A.G.; Sonnichsen, J.C. Westinghouse Hanford Co., Richland, WA (USA). Jun 1989. 35p. Sponsored by DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE89014119/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

At the request of the Washington Department of Ecology and the US Environmental Protection Agency, the US Department of Energy is undertaking a study to document the discharge history and chemical characteristics of liquid discharges to the soil column at the Hanford Site. The activities conducted as part of this study will characterize Hanford Site liquid effluents; assess waste disposal sites and groundwater contamination; and evaluate the potential for migration of contaminants within disposal site soils. The results of the study will be utilized to determine the need for additional liquid effluent analysis, and/or provide a basis for assessing the need for more extensive health risk assessment studies. 13 refs., 3 figs., 2 tabs.

35816 (WINCO–1007) **Evaluation of minimum-fluidizing velocity correlations for bed particles used in fluidized-bed calcination processes.** Kirkbride, R.A. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (USA). Nov 1988. 155p. Sponsored by DOE Nuclear Energy. DOE Contract AC07-84ID12435. Order Number DE89013727/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

Minimum-fluidizing velocities were measured for 73 beds obtained by screening fourteen types of bed material encountered in waste calcination processes. Several mixtures of different particles sizes were also examined. Spherical glass beads were used as a reference material. Particle densities ranged from 1311 to 3630 kg/m^3 and particle diameters ranged from 0.17 to 1.08 mm. Bulk voidages

in the beds ranged from 0.30 to 0.51, and bed voidage at the minimum-fluidizing velocity was 1 to 2% higher than the bulk voidage. Particle sphericities were calculated; their values ranged as low as 0.60. Twenty-three minimum-fluidizing velocity correlations were obtained from a literature search. Minimum-fluidizing velocities predicted by the correlations were compared to experimentally measured minimum-fluidizing velocities for the 73 beds used in this study. The accuracy criterion applied to the correlations was that the predicted values of minimum-fluidizing velocity must be within 20% of the measured value to be considered acceptable. Four correlations reported in the literature showed potential for predicting minimum-fluidizing velocities within 20%. The four acceptable correlations (within 20% accuracy) obtained from the literature predicted minimum-fluidizing velocities within 15% of the measured velocity, for the bed materials tested in this study. 15 refs., 3 figs., 22 tabs.

35817 (WSRC-RP–89-87) **Experimental facilities for pyrochemical development at the Savannah River Site.** Rudisill, T.S. Westinghouse Savannah River Co., Aiken, SC (USA). 1989. 17p. Sponsored by DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-8905122–5-Vugraphs: 13. actinide separations conference, Idaho Falls, ID, USA, May 1989). Order Number DE89013552/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Savannah River Site is installing a multifunctional Pyrochemical Development Laboratory (PDL) to pursue new technology for plutonium recovery. Many future plutonium scrap feed stocks cannot be efficiently processed in SRS facilities using aqueous flow sheets and existing equipment due to poor dissolution behavior or corrosive constituents. Pyrochemical treatment processes will be developed to convert these scraps into viable feedstocks for SRS processing. A technology data base will also be developed for pyrochemical process commonly used to recover plutonium from retired weapon components. The intent of all development programs is to integrate pyrochemical technology with the existing aqueous capabilities at SRS in way that maximizes plutonium recovery, minimize waste generation, and provides an essential contingency capacity for plutonium processing. Five gloveboxes will be provided in the PDL. A stationary, resistance heated furnace will be located in each of two boxes. These furnaces will provide the PDL with the capability to develop flow sheets involving most pyrochemical operations. A third glovebox in the laboratory will be used for plutonium hydriding. Nondestructive analysis (NDA) instrumentation will be installed in a fourth. The furnace, hydriding, and NDA gloveboxes will be provided with high quality argon atmospheres. In order to maintain the purity, the fifth glovebox will serve the primary entrance, exit, and staging area for the glovebox line.

35818 (WSRC-RP–89-288) **Solidification of low-level radioactive waste at the Savannah River Site.** Langton, C.A. Savannah River Lab., Aiken, SC (USA). 1989. 3p. Sponsored by DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-8905152–1: NIST and NRC workshop on cement solidification of low level radioactive waste, Gaithersburg, Maryland, USA, 31 May - 12 jun 1989). Order Number DE89013770/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Aqueous-based process waste and other small volume wastes including basin sludge and incinerator ash will be solidified in cement-based wasteforms at SRS. A variety of inorganic solidifying agents are used depending on the chemistry, contaminants, and processing characteristics of the waste. In some cases, pretreatment of the waste is used to reduce the activity of the waste and/or to remove the hazardous characteristics of the waste. In the case of DWPF saltstone, pretreatment is used to reduce 137 Cs and 90 Sr concentration to Class A levels and in-situ treatment (chemical reactions between the cementitious solids and waste) is used to remove the toxic metal characteristic of the waste. Chemical reduction of the Cr^{+6} to Cr^{+3} and subsequent precipitation of $Cr(OH)_3$, (low solubility) occurs as the result of reactions between the cementitious raw materials and the waste liquid. In summary waste treatment and solidification used at SRS is designed to meet both South Carolina and Federal requirements for maintaining the quality of the groundwater at the disposal site boundary. 2 refs.

35819 Nuclear waste package container corrosion in simulated salt repository environments. Cleary, H.J. (Columbia General, Inc., 110 N. 25 Mile Avenue, Hereford, TX (US)). v.v of Proceedings of the Electrochemical Society fall meeting. Volume 88-2 (extended abstracts). The Electrochemical Society, Pennington, NJ (1988). (CONF-881061–: Electrochemical Society fall meeting, Chicago, IL, USA, 9-14 Oct 1988).

This paper presents an overview of the program conducted by the DOE Salt Repository Project to develop a waste package for long-term containment of high level commercial and defense nuclear wastes in a geological bedded-salt deposit in Deaf Smith County, Texas. Although this location has recently been dropped from further consideration as a possible site for the first national repository, a discussion of the work on corrosion in not brine environments should be of general interest. The basic requirement that must be met by the waste package container has been established by the U.S. Nuclear Regulatory Commission: radionuclides of the nuclear waste must be contained within the waste packages for 300 to 1000 years after closure of the repository. Low carbon steel was selected early in the program because of its good mechanical properties, ease of fabrication (including weldability), low cost, and anticipated low susceptibility to localized corrosion in brine environments. When employed as a thick-walled container, steel would also provide some shielding of the radiation emanating from the waste form. Specific dimensions of the reference container designs varied with the different types of nuclear waste form (defense waste versus assemblies of commercial spent fuel from pressurized-water or boiling-water reactors). The largest container, designed to contain boiling-water reactor fuel assemblies, measured 15.8 feet in length by 33.3 inch outer diameter, and a cylinder wall thickness of 3.9 inches. The wall thickness required to resist lithostatic pressure is 3 inches, leaving an allowance for corrosion losses of 0.9 inch. A total of about 36,000 packages is estimated to be ultimately needed for the first repository using these waste packages designs.

35820 A database for reviews and evaluations of high-level waste documents. Interrante, G.C. (National Bureau of Standards, Gaithersburg, MD (US)); Messina, C.; Harrison, S.A. v.v of Proceedings of the Electrochemical Society fall meeting. Volume 88-2 (extended abstracts). The Electrochemical Society, Pennington, NJ (1988). (CONF-881061–: Electrochemical Society fall meeting, Chicago, IL, USA, 9-14 Oct 1988).

An automated storage and retrieval system that uses a commercially available database management system (DBMS) has been developed to serve as a data index for high-level waste (HLW) reports and as a database containing NBS evaluations of HLW reports. The evaluations are critical reviews of reports, generated mainly by the Department of Energy (DOE), on topics related to processes involved in the degradation of the engineered barrier system designed to contain and control the release of radionuclides contained in waste packages to be placed in a repository for HLW. The intention is to use this system within the framework of the capabilities of a personal computer. The data can be accessed with a DBMS that operates on no more than 512K of memory. All aspects of the PC system are fully functional in respect to the usage of scientific notations, Greek letters and super- and sub-scripts. Thus, on-screen displays, print outs and search strings may contain chemical formulas or proper scientific names. The principal barriers proposed for use in the waste package are metal alloys and borosilicate glass. The technical problems of primary interest in the waste package involve leaching of the glass, corrosion of the alloys, transport processes within the waste package, and modelling efforts aimed at permitting prediction of long-term behaviors. The reviews focus attention on the availability of data that are applicable to the resolution of technical issues that must be considered in the process of obtaining a license to build a repository.

35821 Surface reactions of natural glasses. White, A.F. (Univ. of California, Lawrence Berkeley Lab., Berkeley, CA (US)). v.v of Nuclear waste management II. Passchier, W.F.; Bosnjakovic, B.F.M. American Ceramic Society Inc., Westerville, OK (1986). (CONF-8608225–: 3. international symposium on ceramics in nuclear waste management, Chicago, IL, USA, 28-30 Aug 1986).

Reactions at natural glass surfaces are important in studies involving nuclear waste transport due to chemical control on ground water in host rocks such as basalt and tuff, to potential diffusion into natural hydrated glass surfaces and as natural analogs for waste

glass stability. Dissolution kinetics can be described by linear surface reaction coupled with cation interdiffusion with resulting rates similar to those of synthetic silicate glasses. Rates of Cs diffusion into hydrated obsidian surfaces between 25^0 and 75^0C were determined by XPS depth profiles and loss rates from aqueous solutions. Calculated diffusion coefficients were ten others of magnitude more rapid than predicted from an Arrhenius extrapolation of high temperature tracer diffusion data due to surface hydration reactions.

35822 Recent advances in centrifugal contactor design. Leonard, R.A. (Argonne National Lab., IL (USA)). *Separation Science and Technology (USA),* 23(12,13): 1473-1487 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, TN, USA, 26-29 Oct 1987).

Advances are being made in the design of the Argonne centrifugal contactor for solvent extraction. These contactors are being built, tested, and used to implement the TRUEX process for the cleanup of nuclear waste liquids. These advances include (1) using off-the-shelf, face-mounted motors; (2) modifying the contactor so that relatively volatile solvents can be used; (3) adding a high-level liquid detector that can be used to alert the plant operator of process upsets; (4) providing secondary feed ports; (5) optimizing support frame design; (6) devising a linear design with external interstage lines so that stages can be allocated as needed for extraction, scrub, strip, and solvent cleanup operations; and (7) developing features that facilitate contactor operation in remote facilities.

0530 Environmental Aspects

Refer also to citation(s) 35771, 35772, 35773, 35774, 35775, 35778, 35780, 35782, 35784, 35792, 35793, 35794, 35795, 35796, 35798, 35799, 35802, 35803, 35804, 35805, 35806, 35807, 35808, 35809, 35810, 35811, 35812, 35815, 35816, 35818, 35820, 36888, 37200, 37201, 37202

0540 Health and Safety

Refer also to citation(s) 35785, 35786, 37641

35823 (CONF-890207–35) **Residual radioactive material guidelines: Methodology and applications.** Yu, C.; Yuan, Y.C.; Zielen, A.J.; Wallo, A. III. Argonne National Lab., IL (USA). 1989. 10p. Sponsored by DOE Radioactive Waste Management. DOE Contract W-31109-ENG-38. From Waste management '89; Tucson, Arizona, USA; 26 Feb - 2 mar 1989. Order Number DE89013651/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A methodology to calculate residual radioactive material guidelines was developed for the US Department of Energy (DOE). This methodology is coded in a menu-driven computer program, RESRAD, which can be run on IBM or IBM-compatible microcomputers. Seven pathways of exposure are considered: external radiation, inhalation, and ingestion of plant foods, meat, milk, aquatic foods, and water. The RESRAD code has been applied to several DOE sites to calculate soil cleanup guidelines. This experience has shown that the computer code is easy to use and very user-friendly. 3 refs., 8 figs.

35824 (CONF-890470– IV.A.2.1-IV.A.2.9) **Using computer-based training to facilitate radiation protection review.** Abercrombie, J.S.; Copenhaver, E.D. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

In a national laboratory setting, it is necessary to provide radiation protection overview and training to diverse parts of the laboratory population. This includes employees at research reactors, accelerators, waste facilities, radiochemical isotope processing, and analytical laboratories, among others. In addition, their own radiation protection and monitoring staffs must be trained. To assist in the implementation of this full range of training, ORNL has purchased prepackaged computer-based training in health physics and technical mathematics with training modules that can be selected from many topics. By selection of specific modules, appropriate radiation protection review packages can be determined to meet many individual program needs. Because our radiation protection personnel must have some previous radiation protection experience or the equivalent of an associate's degree in radiation protection for entry level, the computer-based training will serve primarily as review of major principles. Others may need very specific prior training to make the computer-based training effective in their work situations.

35825 (CONF-890470– IV.B.5.1-IV.B.5.12) **Transferring generic SARA/OSHA training to US Department of Energy facilities.** White, A.; McKinley, T. Oak Ridge National Lab., TN (USA). Apr 1989. DOE Contract AC05-76OR00033. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The Technical Resources and Training Section staff at Oak Ridge National Laboratory have developed three extensive training programs for hazardous waste treatment, storage, and disposal facility workers as required by SARA/OSHA, 29 CFR 1910.120. The ORNL program is widely recognized as one of the best in the DOE system. ORNL and ORAU, who manages the Training Resources and Data Exchange (TRADE) network for DOE, entered into a cooperative relationship to respond to the many requests for DOE contractors for copies of the ORNL training materials. This discussion describes the ORNL program and the process of turning it into a series of generic tools which can be used by additional DOE facilities to meet the training requirements established by SARA/OSHA, 29 CFR 1910.120. The speakers describes how the materials are being used by DOE facilities as well as plans for additional resources to be developed through TRADE.

35826 (CONF-890470– IV.B.6.1-IV.B.6.15) **Computer based training state of the art systems.** McCauley, W. (Oak Ridge Associated Universities, TN (USA)); Weseman, M. Oak Ridge National Lab., TN (USA). Apr 1989. DOE Contract AC05-76OR00033. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The use of Computer Based Training (CBT) in the nuclear industry has increased significantly in the last five years. Training professional are faced with many options in selecting instructional systems to help get the job done, and need to know if CBT is an appropriate solution to meet organization needs. The purpose of this paper is to help you assess the advantages and limitations of Computer Based Training and considerations for selecting and implementing CBT systems as one part of an overall training program. Four CBT courses dealing with control of ionizing radiation are reviewed. This paper is written and compiled by the staff of Oak Ridge Associated Universities based on work performed over the last five years for the Department of the Navy, Department of the Army, and the Department of Energy.

35827 (CONF-890470– IV.B.7.1-IV.B.7.6) **Indoctrination: using interactive video to teach attitudes and knowledge in general employee training.** Smigelski, L.B. (Westinghouse Hanford Co., WA (USA)). Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The Westinghouse Hanford Company (WHC) has developed a prototype interactive video course, Hanford General Employee Training (HGET). Interactive video combines sound, motion and still photographs from a videodisc with the graphics, text and instructional capability of computer-based instruction. The course includes indoctrination on over 40 topics identified by the Institute of Nuclear Power Operations (INPO), the US Department of Energy, and the Westinghouse Hanford Company that are to be included in the indoctrination of new and requalifying employees. In addition, the course requires trainees to make positive choices when confronted with real life scenarios showing violations of safety, security and quality standards. This courseware is different from most GET courses because it puts the trainee in a role-playing mode and requires the trainee to recognize and respond in the WHC way. Initial

data project a reduction of 40-60% in training time for HGET as compared to stand-up instruction.

35828 (CONF-890470– V.A.3.1-V.A.3.7) **Management of training counting beans or demonstrating results.** Mooney, W.L. III (Paducah Gaseous Diffusion Plant, KY (USA)). Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

A well-planned, well-staffed and well-housed training program may not function effectively. With the onset of a new DOE order on training design and development methodology, a new audience for a relatively old process will inevitably fall victim to the slam-bang effect. Training personnel are generally enthusiastic and confident about the potential effects of their program. Because they are enthusiastic and put forth a maximum effort, they and their management expect the new program to have dramatic results - a slam-bang effect. As a result, the management of training programs is likely to become an arduous and disappointing task if the manager has no way of showing results. Currently, most of the focus at DOE contractor facilities is on preparation for and ultimate compliance with the DOE order on accreditation with little concern for the method or methods by which to determine its ultimate success or failure. Methods such as program evaluation, goal attainment scaling and multi-attribute utility (MAUT) analysis may provide training management the information to make decisions to improve training quality and demonstrate results. These methods will be discussed in detail and presented as a management tool to complement the accreditation activities at DOE contractor facilities.

35829 (CONF-890470– VI.B.6.1-VI.B.6.8) **Managing training to maximize employee articulation.** Rockwell, N.C. (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls (USA)). Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Through agreements with other training and educational institutions, training managers can make it possible for employees to work toward career and educational goals without having to duplicate previously acquired competencies. By considering both company goals and employee educational goals, training managers can realize some of the articulation benefits typically associated with the public school system. At the Idaho National Engineering Laboratory, several contractor training managers have established cooperative agreements with local college administrators, agreements that allow contractor employees university credit for completing specific contractor training and professional development courses.

35830 (CONF-890470– VI.B.9.1-VI.B.9.8) **Crisis management program for senior officials.** Knazovich, M.; Painter, S. Oak Ridge National Lab., TN (USA). Apr 1989. DOE Contract AC05-76OR00033. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The Emergency Preparedness Special Interest Group (EP SIG), a part of the Training Resources and Data Exchange (TRADE) peer-to-peer network of Department of Energy (DOE) and contractor training and development personnel, developed the Crisis Management Program for Senior Officials. The program was developed in response to commonly-identified training need for basic information in emergency management for DOE and contractor organization senior officials. The Crisis Management Program for Senior Officials is a set of materials which consists of a program brochure, an introductory videotape, an assessment tool for senior officials, a series of five management briefings on crisis management topics, a suggested one-day seminar for senior officials off-site, follow-up activities on-site, and an instructor's guide. The objective of the program is to offer basic information to the senior official on the proper perspective of crisis management, the phases of a crisis, the strategic role of the crisis manager, constraints and consequences of a crisis, and crisis management stress. The knowledge and skills learned in the crisis management program offer an increased awareness to the senior official of the importance of emergency preparedness, planning and practice before a crisis occurs.

35831 (GAO/RCED–88-130) **Nuclear health and safety.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1988. 9p. Available from General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

Many of the Department of Energy's facilities are deteriorating to the point that new facilities or major upgrades are needed to maintain the nation's capability to produce nuclear material. Important safety and environmental concerns have been raised about DOE reactors and other nuclear defense facilities GAO believes that ens of billions of dollars will be needed to rebuild, clean up, and improve safety at DOE installations; DOE has stated that environmental cleanup at DOE facilities could cost as much as $100 billion. At this time, however, it is unclear how, where, and in what time frame these corrective actions will be accomplished.

35832 (INIS-mf–11457(v.1,2) v. 1) **Optimization of radiation protection.** Beninson, D. Canadian Nuclear Association, Toronto, ON (Canada); Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1985. (CONF-841016–: International conference on occupational radiation safety in mining, Toronto, Ontario, Canada, 15-18 Oct 1984). In *Occupational radiation safety in mining. Proceedings of the international conference (in two volumes).* Order Number DE89619926/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The paper discusses some aspects of the requirements of keeping doses 'as low as reasonably achieveable'. This requirement, called the optimization of radiation protection, is presented as a typical case of Decision Analysis. Special problems encountered in defining the period of integration of collective dose or its coverage in space are also discussed, as well as the effects of uncertainty in the assessments.

35833 (INIS-mf–11457(v.1,2) v. 1) **Removal of airborne thoron (radon) daughters on mine walls and other surfaces by convective deposition and electrostatic plate-out.** Bigu, J. (Department of Energy, Mines and Resources, Elliot Lake, ON (Canada). Elliot Lake Lab.). Canadian Nuclear Association, Toronto, ON (Canada). 1985. (CONF-841016–: International conference on occupational radiation safety in mining, Toronto, Ontario, Canada, 15-18 Oct 1984). In *Occupational radiation safety in mining. Proceedings of the international conference (in two volumes).* Order Number DE89619926/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Experimental data on thoron(radon) daughter plateout phenomena on walls by convective and electrostatic deposition are presented. Experiments were carried out in underground uranium mines and in the laboratory. Measurements were conducted under a wide range of environmental conditions including relative humidity (30-90%), temperature (14-25 degrees C), aerosol concentration ($1x10^3$ - $2x10^5$ cm^{-3}), and air velocity (0-1.2 m/s). Experimentally determined radon and thoron daughter deposition velocities were in the range 0.06-0.6 cm/s. These values are substantially lower than theoretical estimates by several authors on which plate-out calculations are based. The effect of an electrostatic field on the removal of thoron daughters has also been investigated. DC voltages ranging from 0 Volts to ±1000 Volts were applied to aluminum metal mesh electrodes. Measurements show quite a substantial reduction in the thoron daughter Working Level, about a factor 2 to 4, when a voltage between -300 V and -1000 V is applied to the metal mesh.

35834 (INIS-mf–11457(v.1,2) v. 1) **Identification of nonuranium mines which present a radon risk through measurements of exhaust air.** Bernhard, S. (Centre d'Etude sur l'Evaluation de la Protection dans le Domaine Nucleaire, 92 - Fontenay-aux-Roses (France)); Le Gac, J.; Zettwoog, P. Canadian Nuclear Association, Toronto, ON (Canada). 1985. (CONF-841016–: International conference on occupational radiation safety in mining, Toronto, Ontario, Canada, 15-18 Oct 1984). In *Occupational radiation safety in mining. Proceedings of the international conference (in two volumes).* Order Number DE89619926/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The following data were gathered in the measurement campaigns conducted only on the air exhausts of some fifty European Community mines in 1983: identification of the mine, mining method, measurement of radon concentrations at mine entrance and exhaust air, ventilation flowrate at air exhaust point(s), equivalent length developed by the stope-gallery network assigned to each air exhaust of the mine, mean cross-section assigned to the overall network of stopes and galleries of each mine, measurement of potential alpha energy concentrations of radon 222 and radon 220 daughters. These data were processed to meet the following objectives: identification of mines with potential radiological risk, determination by the forecasting model of probable minimum levels of worker exposure to radon 222 daughters, quality assurance of secondary ventilation, identification of convective transfer mechanisms by air or water within the rock.

35835 (INIS-mf–11457(v.1,2), pp. 704) **Air purification techniques for radon daughters in uranium mines.** Pourprix, M. (Centre d'Etude sur l'Evaluation de la Protection dans le Domaine Nucleaire, 92 - Fontenay-aux-Roses (France)); Vendel, J.; Zettwoog, P. Canadian Nuclear Association, Toronto, ON (Canada). 1985. (In French). (CONF-841016–: International conference on occupational radiation safety in mining, Toronto, Ontario, Canada, 15-18 Oct 1984). In *Occupational radiation safety in mining. Proceedings of the international conference (in two volumes).* Order Number DE89619926/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

A modified air purifier to filter air was built to reduce radon daughter concentrations in uranium mines, and thus reduce exposure of miners. The main experimental results for the purifiers are presented for several levels: individual purification; secondary ventilation; purification; and primary ventilation purification. The study concentrates on secondary ventilation purification. For this case the electrostatic technique is preferred.

0550 Safeguards, Inspection, and Accountability

Refer also to citation(s) 36892, 37789, 37790, 37791

35836 (CONF-890565–7) **Implementation of isotope correlation technique for safeguards.** Persiani, P.J.; Bucher, R.G. Argonne National Lab., IL (USA). 1989. 8p. Sponsored by DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 11. annual ESARDA symposium on safeguards and nuclear materials management; , Luxembourg; 30 May - 1 jun 1989. Order Number DE89013286/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The isotopic correlation technique (ICT) is based on the fundamental physics principle that the isotopic compositions of nuclear material in the fuel cycle systems contain information regarding the design and history of nuclear material flow from fuel fabrication, reactor operation, and through input to the reprocessing plant. Isotopic Correlation in conjunction with the gravimetric (or Pu/U) method for mass determination can be developed to provide an independent in-field verification of the reprocessing input accountancy at the dissolver and/or accountancy stage of the reprocessing plant. The Argonne National Laboratory program in isotope correlation techniques is based on three-dimensional reactor physics calculations of characteristic geometries/composition in each reactor class. 10 refs., 1 fig., 3 tabs.

35837 (IAEA-INFCIRC–360) **Agreement of 27 September 1988 between the International Atomic Energy Agency and the Government of India for the application of safeguards in connection with the supply of a nuclear power station from the Union of Soviet Socialist Republics.** International Atomic Energy Agency, Vienna (Austria). Jan 1989. 14p. Order Number DE89620442/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The full text of the Agreement of 27 September 1988 between the Agency and the Government of India for the application of safeguards in connection with the supply of a nuclear power station composed of two pressurized light water reactors, each of 1000 MW(e) from the Union of Soviet Socialist Republics is reproduced.

35838 (LA-UR–89-1558) **LAVA [Los Alamos Vulnerability and Risk Assessment] and classical risk analysis.** Smith, S.T. Los Alamos National Lab., NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8906141–1: Computer security risk management model builders workshop, Ottawa, Canada, 20-22 Jun 1989). Order Number DE89013210/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

LAVA (the Los Alamos Vulnerability/Risk Assessment system) is a three-part systematic approach to risk assessment that can be used to model risk assessment for a variety of application systems such as computer security systems, communications security systems, information security systems, and others. The first part of LAVA is the mathematical methodology based hierarchical systems theory, fuzzy systems theory, decision analysis, utility theory, and cognitive science; clear relationships exist between LAVA's approach and classical risk analysis. The second part, written for a large class of personal computers, is the general software engine that implements the mathematical risk model. The third part is the application data sets, each written for a specific application system; all application-specific information is data. Application models are knowledge-based expert systems to assess risks in application systems comprising sets of threats, assets, undesirable outcomes, and safeguards. The safeguards system model is in three segments: sets of safeguards functions for protecting the assets from the threats by preventing or ameliorating the undesirable outcomes, sets of safeguards subfunctions whose performance determines whether the function is adequate and complete, and sets of issues, appearing as interactive questionnaires, whose measures define both the weaknesses in the safeguards system and the potential costs of undesirable outcome occurrence. 29 refs.

35839 (LA-UR–89-2031) **Application of process monitoring to verify facility design.** Hakkila, E.A. Los Alamos National Lab., NM (USA). 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890736–30: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, FL, USA, 9-12 Jul 1989). Order Number DE89014314/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Process monitoring has been proposed as a safeguards measure to ensure that a facility is operating as designed, or as a surveillance measure to ensure that material is not removed from the facility in an undeclared manner. In a process-monitoring system, the facility operator monitors process operations such as tank levels, densities, and temperatures; process flows; and physical parameters such as valve positions to ensure that the operations performed are both desired and required. At many facilities (for example, Idaho), the process-monitoring system is also an important safety feature to prevent criticality. Verifying facility design is necessary for application of safeguards in a reprocessing plant. Verifying all pipes and valves through comparison of blueprints with the as-built facility is an almost impossible task with the International Atomic Energy Agency's limited inspection resources. We propose applying process monitoring for international safeguards facility design verification. By carefully selecting process-operating variables, it may be possible to verify that plant flows are as described and that key measurement points are not bypassed. 8 refs.

35840 (LA-UR–89-2047) **Unique applications of tamper indicating devices.** Erkkila, B.H. Los Alamos National Lab., NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890736–29: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, FL, USA, 9-12 Jul 1989). Order Number DE89014310/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Various organizations at Los Alamos have used tamper indicating devices (TID) to help control nuclear materials for several years. During the past year a formal documented TID program has been developed to be implemented throughout the Laboratory. Special needs of all organizations have been incorporated into the program. Applications vary from waste containers to unique configurations of special nuclear materials (SNM). Several examples of these applications will be discussed.

35841 (NUREG/CR–4934) **Closeout of IE Bulletin 83-06: Nonconforming materials supplied by Tube-Line Corporation**

Facilities at Long Island City, New York; Houston, Texas; and Carol Stream, Illinois. Dean, R.S.; Foley, W.J.; Hennick, A. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Operational Events Assessment; Parameter, Inc., Elm Grove, WI (USA). May 1989. 37p. Sponsored by Nuclear Regulatory Commission. (PARAMETER/IE–169). Available from NTIS, PC A03/MF A01 - OSTI.

Documentation is provided in this report for the closeout of IE Bulletin 83-06 regarding nonconformities of certain materials which were obtained directly or indirectly from the Tube-Line Corporation (T-L) for use in safety-related systems. Closeout is based on the implementation and verification of four (4) required actions by licensees and holders of construction permits of nuclear power reactor and nuclear fuel facilities. From evaluation of responses and NRC/Region inspection reports, it is concluded that the concerns of the bulletin have been resolved. The bulletin is closed for all of the 120 power reactor facilities and for both of the two nuclear fuel facilities to which it was issued for action. Background information is supplied in the Introduction and Appendix A. 3 refs., 5 tabs.

35842 (POEF–2007) **Long-range health and safety management plan, fiscal years 1989–1995.** Martin Marietta Energy Systems, Inc., Piketon, OH (USA). Jun 1989. 136p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-76OR00001. Order Number DE89014234/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This Health and Safety Long Range Plan (LRP) analyzes health and safety programs at the Portsmouth Gaseous Diffusion Plant (PORTS) and details areas of strength and plans for overcoming noted deficiencies (existing and anticipated). Major areas of focus are health physics, industrial hygiene, nuclear criticality safety, nuclear facility safety, transportation safety, fire protection, industrial safety, emergency preparedness, and occupational medicine.

35843 (RFP–4296) **TRIFID [TRansuranic Isotopic Fraction Interrogation Device]: A second generation plutonium isotopic analysis system.** Fleissner, J.G.; Coressel, T.W.; Freier, D.A.; Macklin, L.L. Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant. 1989. 29p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP03533. (CONF-890736–13: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, FL, USA, 9-12 Jul 1989). Order Number DE89014174/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The TRIFID (Transuranic Isotopic Fraction Interrogation Device) system is a second generation plutonium isotopic analysis system which incorporates many new and unique features in the area of isotopic data acquisition and isotopic analysis instrument consisting of a Canberra Series 95-MCA interfaced to a Compaq 386 computer. The entire TRIFID software package, including MCA communications and isotopic analysis routines, was developed using the C programming language. Extensive use has been made of user friendly screens and menus for ease of operation and training and to facilitate use by technical level operators. Automated TRIFID features provide for MCA/ADC setup and acquisition, spectral storage, isotopic analysis, and report generation. One unique feature of the TRIFID system design allows it to be pre-programed for an entire day's counting. The isotopic analysis module (EPICS) contains an expert system formalism which is used to detect and assay for spectral interferences, and to automatically adjust peak fitting constraints based on spectral intensity variations. A TRIFID system has been in operation in a production laboratory at the Rocky Flats Plant since September 1988. Marked decreases in training and hands-on operation time have been achieved in comparison to the older, preceding isotopic systems. 2 refs., 3 figs.

35844 (RFP–4307) **Use of nuclear material control specialists for material surveillance.** Mullet, R.D. Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant. 1989. 4p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP03533. (CONF-890736–14: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, Florida, USA, 9-12 Jul 1989). Order Number DE89014176/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The new Control and Accountability of Nuclear Material Department of Energy (DOE) Order 5633.3 states that "each facility shall establish a graded safeguard program for monitoring nuclear materials and detecting unauthorized activities or anomalous conditions." Rockwell developed a new position description and hired Nuclear Materials Control (NMC) Specialists as a part of the graded materials surveillance program at Rocky Flats (RF). The NMC Specialists provide material surveillance in Material Access Areas (MAA) during all shifts when operations are in progress. By design, NMC Specialists do not handle special nuclear materials (SNM) in accordance with separation of duties and responsibilities requirements. In support of the effort to assure SNM are accessed only by authorized personnel, the NMC Specialist can serve as the second person for those activities that require two persons such as accessing storage areas containing SNM and SNM transfers between MAAs. NMC Specialists respond immediately to material control alarms, assess and document the nature of the alarm, and assist management with resolution. They perform daily administrative inventory checks to determine the integrity of the inventory and advise management daily of the results. NMC Specialists perform confirmation and coordinate verification measurements on the inventory each month utilizing statistical sampling plans. The purpose of this paper is to describe how utilization of NMC Specialists has enhanced the material surveillance program at RF.

35845 (SAND–89-1110C) **Modular economical PC-based alarm display system.** Clark, C.M.; Christoffersen, D.A. Sandia National Labs., Albuquerque, NM (USA). 1989. 6p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–21: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, Florida, USA, 9-12 Jul 1989). Order Number DE89014479/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Historically, large scale safeguards alarm and communication systems have required the expensive computational power of a mainframe of midsize computer. Due to the widespread availability and reduced cost of PC-based technology, this class of machine is a much preferred solution. This paper will discuss a development program integrating this technology with inexpensive local area network (LAN) hardware to support (1) many touch panel based operator graphics consoles, (2) redundant LAN communications, (3) fault-tolerant LAN communication, (4) redundancy in subsystem failure, (5) modularity in design, (6) fault-tolerant video communication, (7) inexpensive PC-based video annotation and switcher design, (8) inexpensive video replay capability, (9) use of fiber optic communication media, (10) distributed parallel processing, and (11) minimized overall system cost. The Intel BitBus architecture was selected for network communications between PC CPUs. The network supports both fiber optic and copper media and insures message integrity/receival. Custom boards have been developed to transform PCs modular expandable routing switchers with video presence detection and annotation. 1 fig.

35846 (SAND–89-1111C) **Argonne Unified Safeguard: An integrated materials monitoring/tracking and accounting system.** Henslee, S.P.; Jackson, B.G.; Roybal, J.A.; Garcia, B. Sandia National Labs., Albuquerque, NM (USA). 1989. 11p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–19: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, Florida, USA, 9-12 Jul 1989). Order Number DE89014481/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Current work in the area of integrated materials monitoring/tracking and accounting at Argonne National Laboratory-West (ANL-W) has resulted from the development of materials accounting system by Los Alamos National Laboratory (LANL) and a demonstrated personnel and materials tracking system by Sandia National Laboratories (SNL). The integration of these two systems has culminated in the current system effort which is called the ARGonne Unified Safeguard (ARGUS) system. The ARGUS system is made up of three major components. These components perform the functions of observing all container movements, authorized materials access approval, initiation and receipt of materials transfers, and perform materials accounting for the facility. ARGUS system benefits can be summarized through system capabilities as follows: near real-time accountability, full traceability of materials access and transfer, enforcement of approved personnel access to materials,

electronic confirmation of materials surveillance procedures during materials access and transfers, continuous surveillance of all material not directly involved in the manufacturing process, transfer and receipt, and automatic notification to security for identified anomalies. This paper will concentrate on the overall ARGUS system, its operational impacts and advantages. 2 refs., 2 figs.

35847 (SAND–89-1601C) **The assess facility descriptor module.** Jordan, S.E.; Winblad, A.; Key, B.; Walker, S.; Renis, T.; Saleh, R. Sandia National Labs., Albuquerque, NM (USA). 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–11: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, Florida, USA, 9-12 Jul 1989). Order Number DE89014070/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Facility Descriptor (Facility) module is part of the Analytic System and Software for Evaluating Safeguards and Security (ASSESS). Facility is the foundational software application in the ASSESS system for modelling a nuclear facility's safeguards and security system to determine the effectiveness against theft of special nuclear material. The Facility module provides the tools for an analyst to define a complete description of a facility's physical protection system which can then be used by other ASSESS software modules to determine vulnerability to a spectrum of insider and outsider threats. The analyst can enter a comprehensive description of the protection system layout including all secured areas, target locations, and detailed safeguards specifications. An extensive safeguard component catalog provides the reference data for calculating delay and detection performance. Multiple target locations within the same physical area may be specified, and the facility may be defined for two different operational states such as dayshift and nightshift. 6 refs., 5 figs.

35848 (SAND–89-1603C) **The ASSESS Neutralization Analysis module.** Paulus, W.K.; Jordan, S.E.; Moore, M.; Mondragon, J. Sandia National Labs., Albuquerque, NM (USA). 1989. 14p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–12: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, Florida, USA, 9-12 Jul 1989). Order Number DE89014801/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The ASSESS Neutralization Analysis module (Neutralization) is part of Analytic System and Software for Evaluation of Safeguards and Security, ASSESS, a vulnerability assessment tool. Neutralization models a fire fight engagement security inspectors (SIs) and adversaries. Results are based on probability of neutralization, P(N), which estimates the likelihood that SIs will win, given that SIs interrupt the attackers and begin an armed engagement. The calculating engine of the module is the Brief Adversary Threat Loss Estimator, BATLE. Engagements can have as many as thirty combatants on a side. Reinforcements may be introduced or combatant characteristics may be changed as many as ten times in one engagement. Inputs may be made with or without programmed guidance to the user. Combatant characteristics come from a modifiable library. Seven different characteristics can be independently specified for each combatant. Graphs of time distributions and studies of the sensitivity of P(N) to any combatant characteristic of either SIs or adversaries can be requested. Output files from Neutralization are used by Outsider Analysis to produce probability of security system win. 4 refs., 12 figs., 2 tabs.

35849 (SAND–89-1604C) **The Outsider interruption algorithm.** Snell, M.; Bingham, B. Sandia National Labs., Albuquerque, NM (USA). 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–8: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, FL, USA, 9-12 Jul 1989). Order Number DE89014799/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Outsider Analysis (Outsider) module is part of the Analytic System and Software for Evaluation of Safeguards and Security (ASSESS). Outsider and the ASSESS Facility Descriptor (Facility) module together supercede the Systematic Analysis of Vulnerability to Intrusion (SAVI) PC software package. Outsider calculates P(I), the probability that outsiders are interrupted during an attack on a facility by security forces at the facility, and P(W), the probability of security system win. SAVI exhaustively examines every possible path to find the ten most vulnerable paths. Exhaustive search is adequate if the number of paths to examine is small, but moderately complex facilities can have millions of paths, making exhaustive search too slow for practical purposes. Outsider has two new algorithms that generate paths in order of vulnerability, finishing in a fraction of the time required by SAVI. The new Outsider algorithms make containment analysis easier for analysts than ever before. We describe the new algorithms and show how much better they perform than the SAVI exhaustive search algorithm. 6 refs., 5 figs., 2 tabs.

35850 (SAND–89-1605C) **A demonstration of ASSESS: Analytic System and Software for Evaluating Safeguards and Security.** Matter, J.C.; Al-Ayat, R.A.; Cousins, T.D. Sandia National Labs., Albuquerque, NM (USA). 1989. 6p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–10: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, Florida, USA, 9-12 Jul 1989). Order Number DE89014803/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper demonstrates the use of the Analytic System and Software for Evaluating Safeguards and Security. ASSESS is an integrated approach for evaluating the effectiveness of safeguards against theft of special nuclear material by different types of adversaries: insiders, outsiders, and colluding insiders and outsiders. ASSESS consists of six modules: System Manager, Facility Descriptor, Insider Analysis, Outsider Analysis, Neutralization Analysis, and Collusion Analysis. This paper introduces the modules, describes their scope, and highlights the interactions among them. Separate papers will provide detailed discussion and demonstration of each of the modules. The ASSESS code runs on the IBM PC family of computers with 640K RAM, the DOS operating system, and Microsoft Windows. The Windows environment provides a very efficient and convenient graphics user interface as well as drivers for many types of output devices. ASSESS is being developed jointly by Lawrence Livermore National Laboratory and Sandia National Laboratories under the sponsorship of the Department of Energy (DOE) Office of Safeguards and Security. The first version of the ASSESS code was delivered to DOE/OSS in March 1989. 7 refs., 4 figs.

35851 (SAND–89-1645C) **Target cueing and tracking system for safeguards and security.** Darnell, R.A.; Eilers, D.L.; Schnetzer, E.E. Sandia National Labs., Albuquerque, NM (USA). 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–31: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, FL, USA, 9-12 Jul 1989). Order Number DE89013923/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

There are many Safeguards applications which have a need for a reliable system that uses state-of-the-art processing techniques to detect and track targets moving through a scene. A general purpose Target Cueing and Tracking System (TCATS), which is independent of the application and the user interface, is under development. The TCATS algorithms were developed and evaluated with commercially available image processing boards and a VME bus based microcomputer. The TCATS algorithms have successfully demonstrated a high detection capability and the ability to ignore exterior environmental conditions, such as cloud shadows moving through the scene, snow, blowing dust, rain, and moderate camera motion. These algorithms remove camera motion. These algorithms remove camera motion and perform target detection and tracking at near real time. The algorithms can handle many targets and retain the identity of each object from one frame to the next. Special ruggedized hardware is also under development to reduce the size, cost, and power consumption, and to increase the processing rate, reliability, and environmental operating capability of the TCATS. Field evaluations are underway specifically for Exterior Fixed Site Security applications. Testing includes nuisance alarm data gathering and detection capability evaluation of human targets crossing perimeter zones. This paper describes the detection and tracking techniques, custom hardware, and future development plans for the TCATS. 5 refs., 9 figs.

0560 Legislation and Regulations

Refer also to citation(s) 35785, 35786, 35791, 35819, 37345

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

Refer also to citation(s) 36026, 36127

0702 Radiation Sources

35852 (INIS-mf–11396, pp. 95) **Neutron activation of large samples using a one milligram Californium 252 source.** Lycoudi, M. (Wits-CSIR Schonland Research Centre for Nuclear Sciences, University of the Witwatersrand, Johannesburg (South Africa)); Watterson, J.I.W. South African Inst. of Physics, Faure (South Africa). 1987. (CONF-8707216–: 32. Annual conference of the South African Institute of Physics, Durban, South Africa, 13-17 Jul 1987). In *32nd Annual conference and the 22nd annual theoretical seminar of the South African Institute of Physics.* Order Number DE89615754/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

This publication contains only the abstracts of seminars.

ACTIVATION ANALYSIS/californium 252; ACTIVATION ANALYSIS/ores; NEUTRONS; ORES; SAMPLING; SENSITIVITY

35853 (KURRI-TR–302, pp. 44-48) **Focused ion beam processing.** Gamo, Kenji (Osaka Univ., Toyonaka (Japan). Faculty of Engineering Science). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. May 1988. (In Japanese). (CONF-8707203–: Specialist research meeting on semiconductors with research reactors; Specialist research meeting on semiconductors with research reactors, Kyoto, Japan; KUMATORI, Japan, 27 Jul 1987; 18 jan 1988;CONF-8801165–). In *Proceedings of the specialist research meetings on semiconductors with research reactors.* Order Number DE89003365/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

ION BEAMS/fabrication; FABRICATION; ION IMPLANTATION; ION SCATTERING ANALYSIS; SURFACE TREATMENTS; ETCHING

35854 (KURRI-TR–302, pp. 49-53) **Low-energy ion shower doping and its application for electronic devices.** Yoshida, Akihisa (Matsushita Electric Insdustrial Co. Ltd., Moriguchi, Osaka (Japan). Central Research Labs.); Setsume, Kentaro; Hirao, Takashi. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. May 1988. (In Japanese). (CONF-8707203–: Specialist research meeting on semiconductors with research reactors; Specialist research meeting on semiconductors with research reactors, Kyoto, Japan; KUMATORI, Japan, 27 Jul 1987; 18 jan 1988;CONF-8801165–). In *Proceedings of the specialist research meetings on semiconductors with research reactors.* Order Number DE89003365/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

CRYSTAL DOPING/ion beams; ION IMPLANTATION; SILICON; PHOSPHINES; KEV RANGE 01-10; SEMICONDUCTOR DEVICES

35855 (KURRI-TR–302, pp. 54-59) **Application of ion beams below several hundreds of electron volts. Application to thin film formation.** Ishikawa, Junzo (Kyoto Univ. (Japan). Faculty of Engineering). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. May 1988. (In Japanese). (CONF-8707203–: Specialist research meeting on semiconductors with research reactors; Specialist research meeting on semiconductors with research reactors, Kyoto, Japan; KUMATORI, Japan, 27 Jul 1987; 18 jan 1988;CONF-8801165–). In *Proceedings of the specialist research meetings on semiconductors with research reactors.* Order Number DE89003365/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

When used for irradiation of solid material, ion beams with an energy of less than several hundreds of electron volts give a sputtering ratio of less than unity, making it possible to perform deposition by using the ion beams. Ions have a potential energy which is larger by the ionization energy than other particles and has a kinetic energy far larger than the thermal energy. The ion beam deposition process can work very effectively in the field of thin film formation. Various advantages obtainable by applying the process to thin film formation are described, focusing on the formation of thin film of nitride and oxide of aluminum and silicon by an ion beam deposition apparatus consisting of a microwave ion source and an ICB system, and the formation of carbon film by carbon anion beams supplied by a mass-separated anion beam deposition apparatus. Major advantages of using ion beams are: increase in chemical reactivity to permit film formation at lower temperatures; accurate control of the amount of reactive gas particles to permit control of the composition; availability of the effect of kinetic energy of ions to permit control of crystalinity; and synthesis of impurity-free compounds to permit the formation of pure film. (N.K.).

0704 Economics

35856 (PNL–6934) **US Department of Energy radioisotope customers with summary of radioisotope shipments, FY 1988.** Van Houten, N.C. Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 47p. Sponsored by DOE Energy Research. DOE Contract AC06-76RL01830. Order Number DE89014583/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Pacific Northwest Laboratory (PNL) prepared this edition of the radioisotope customer list at the request of the Office of Health and Environmental Research (ER-73), Office of Energy Research, US Department of Energy (DOE). This is the 25th report in a series dating from 1964. This report covers DOE radioisotope sales and distribution activities by its facilities to domestic, foreign and other DOE facilities for FY 1988. The report is divided into five sections: radioisotope suppliers, facility contacts, and radioisotopes or services supplied; a list of customers, suppliers, and radioisotopes purchased; a list of radioisotopes purchased cross-referenced to customer numbers; geographic locations of radioisotope customers; and radioisotope sales and transfers – FY 1988. Radioisotopes not previously reported in this series of reports were argon-37, arsenic-72, arsenic-73, bismuth-207, gadolinium-151, rhenium-188, rhodium-101, selenium-72, xenon-123 and zirconium-88. The total value of DOE radioisotope sales for FY 1988 was $11.1 million, an increase of 3% from FY 1987.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

Refer also to citation(s) 35902, 35905, 35906, 36423, 36733, 36734

35857 (EC/WTC–1989) **Creating fuel oil from sewage sludge.** Environment Canada, Burlington, ON (Canada). Wastewater Technology Centre. [1989]. 6p. (In English and French). (MICROLOG–88-04804). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Environment Canada's Wastewater Technology Centre at Burlington, Ontario has developed new cost-efficient processes to deal with wastewaters produced by industry and municipalities. This pamphlet gives an overview of a process originally developed by Tubingen University in Germany in which dried municipal sludge is heated to 300-350^{0}C in an oxygen-free environment and converted to fuel oil, char, reaction water, and noncondensable gas, collected separately. The economic and environmental advantages of the system are described. 1 fig.

35858 (PB–89-166722/XAB) **Wood sugars to energy-intensive organic chemicals: Phase 1. Final report.** Belfort, G.; Dziewulski, D.M.; Nauman, E.B. Rensselaer Polytechnic Inst., Troy, NY (USA). Jul 1985. 84p. Available from NTIS, PC A05/MF A01.

This report describes research into the conversion of wood sugars, derivable from abundant New York State hardwoods, to high-value petrochemicals. The current phase of research emphasized the production of levo-2,3 butanediol by fermentation of glucose using Bacillus polymyxa. A key technology, use of ceramic hollow fibers for recycle of live cells, was demonstrated in the feasibility study. Butanediol is one of several possible products, such as glycerol, succinic acid, and acetic acid, that are now produced from petroleum or natural gas, but which could be produced from wood. The study concludes, on a preliminary basis, that production of butanediol from wood-derived glucose is economically feasible. Further development is needed to make the process continuous and optimize various steps including product extraction. Future work will focus on development of a continuous reactor and the use of a lower-cost wood sugar, xylose, as the feedstock.

35859 (PB–89-167217/XAB) **Conversion of methanol over zeolite ZSM-5.** Howden, M.G. Council for Scientific and Industrial Research, Pretoria (South Africa). Jul 1987. 22p. (CSIR-CENG–654). Available from NTIS, PC EE04/MF E04.

Summary in Afrikaans. North American Continent sales only.

Methanol can be derived from either coal or natural gas. There is great interest in South Africa in the production of synthetic fuels from such methanol, particularly when zeolite ZSM-5 is used as the catalyst. This report reviews the various parameters that control the conversion of methanol into the different types of liquid fuel.

35860 (PB–89-173199/XAB) **Identification and characterization of reaction steps and enzyme catalysts involved in the conversion of acetate and methyl groups to methane. Final report, October 1984-October 1987.** Stadman, T.C.; Grahame, D.A. National Heart, Lung, and Blood Inst., Bethesda, MD (USA). Feb 1988. 38p. Available from NTIS, PC A03/MF A01.

The overall objective of the research is to identify the enzymatic steps involved in the reduction to methane of the methyl group of acetate and certain other one-carbon compounds (e.g., methanol, formate, CH_3-SCoM, or CH_3-B12). Studies on the mechanism of action of the enzymes involved would ultimately provide information which could be used in constructing synthetic or semi-synthetic catalysts for industrial purposes, and would be extremely helpful in the design of methods to improve the efficiency and reliability of bioconversion processes. The initial goals were to develop procedures by which the enzymes suspected to be involved can be purified in sufficiently large quantities for biochemical studies of their structure and function. The enzymatic components were to be characterized in detail such that experiments could be undertaken to determine their exact roles and mechanisms of action in methanogenesis. This course of action was pursued with the two enzymes carbon monoxide dehydrogenase and Co-methylcobamide:2-thioethanesulfonate methyltransferase.

35861 (PB–89-178784/XAB) **Electrochemical conversion of C(1) molecules. Final report, February 1, 1986-December 31, 1988.** Sammells, A.F.; Cook, R.L.; Wessels, B.W. Eltron Research, Inc., Aurora, IL (USA). Feb 1989. 173p. Available from NTIS, PC A08/MF A01.

This report identifies new efficient systematic electrocatalysis strategies for the electrochemical and photoelectrochemical (PEC) generation of hydrogen or hydrogenated inorganic substrate molecules to give useful gaseous fuels. Selected electrocatalysts would then be utilized in novel cell configurations. Basic insight gained would lead to new approaches for direct methane activation leading to more valuable products.

35862 (SU–7906) **Study of the conversion of lignocellulosic (aspen) materials to liquid fuels and chemicals.** Pepper, J.M.; Eager, R.L.; Mathews, J.F. Saskatchewan Univ., Saskatoon, SK (Canada). 1979. 31p. (CONF-7906193–: Chemical Institute of Canada annual conference, Vancouver, Canada, 1 Jun 1979;CE–02419). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

Studies were completed on the use of the small-scale semi-continuous reactor whereby lignocellulosic materials may be converted into a fuel oil. Changes in design and operation were made and further data obtained as a result of studies of the following parameters: pretreatment with sulfuric acid, operating pressure, presence or absence of CO, and nature of feedstock. The major study has centered around the design, construction and testing of a small-scale continuous reactor whose operation was based upon the use of a newly designed screw unit to compress and deliver the wood meal to the reactor site. Chemical studies on oils were obtained from both wood and cellulose. Semi-continuous reactor experiments were run to demonstrate that proto oil could be made continuously under conditions similar to batch runs, and to outline the ranges of the process variable in which satisfactory operation can be maintained for extended periods of time. 7 refs., 4 figs., 5 tabs.

0902 Alcohol Fuels

Refer also to citation(s) 35905, 36442, 36999

35863 (PB–89-166714/XAB) **Recycling of cellulose enzyme complex after cellulose hydrolysis. Final report.** Ciesceri, L.S. Rensselaer Polytechnic Inst., Troy, NY (USA). Mar 1985. 46p. Available from NTIS, PC A03/MF A01.

This report describes the development of a low-cost process for the recycling of enzymes used in cellulose hydrolysis. The enzymes can be used in an advanced technology to convert cellulose, a component of wood and paper, to sugar for the production of fuel ethanol. The market for fuel ethanol, used as an octane booster in gasoline, is growing. New York State has an abundant resource base in its forests and paper wastes that could be used to produce fuel ethanol. The enzymes used in the process are expensive, however, and recycling is important to control costs. This project resulted in the development of a simple, inexpensive method of recycling the active components of the enzymes.

35864 **Cost goals for biofuels technologies.** Gaines, L.L. (Argonne National Lab., 9700 South Cass Avenue, Argonne, IL (US)); Flaim, S.J. v.v of Energy from biomass and wastes XI. Klass, D.L. Institute of Gas Technology, Chicago, IL (1988). (CONF-870364–: 11. IGT conference on energy from biomass and wastes, Orlando, Florida, USA, 16-20 Mar 1987).

Federally funded energy research seeks to demonstrate that alternative fuels can be produced and then to induce private sector involvement by showing that they can be produced profitably. Prices for fossil fuels may be used as cost goals for biofuels to determine when profitability may be achieved. Achieving equality with fossil fuel prices drives out the highest-cost sources of supply and enables initial market penetration; as costs decrease, biofuels can potentially gain a greater market share. However, achieving competitive costs is not a sufficient condition for success unless prices of conventional substitutes are expected to rise. Cost goals are used for research planning purposes, as a common denominator to allow comparisons among many biofuels options. Application of standard investment criteria to biofuels R and D would require that benefits from their use pay back research costs. These benefits must be discounted because they are realized in the future. Furthermore, realization of future savings is uncertain, so risks must be accounted for. Research may be justified if the expected value of the discounted benefits is greater than the discounted cost of the research. Cost goals satisfying this condition might be substantially lower than projected fuel prices. This paper examines recent fossil fuel price projections and discusses the challenges biofuels research faces just to produce competitive products.

0904 Solid Waste and Wood Fuels

Refer also to citation(s) 35864, 35902

35865 (ETDE/CA-MS–8709) **Whitehorse efficient woodheat demonstration.** Simons, C.A.; Christiansen, P.D.; Pritchett, L.C.; Beyerman, G.A. Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1987. 294p. (MICROLOG–89-02263). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

To determine the effectiveness of the new woodheat technologies under in-home conditions, the City of Whitehorse, Energy, Mines and Resources Canada, and the Government of the Yukon funded a demonstration of those technologies not previously evaluated under in-home conditions. The study was designed to demonstrate the effectiveness of these technologies in reducing the impact of residential woodheat emissions on ambient air quality; reducing the risk associated with chimney fires and safety of operation in the home; and improving the energy efficiency of residential woodheating. These objectives were to be achieved by quantifying the emission characteristics of both coventional and new residential woodheat technologies (integral catalytic woodstoves, catalytic add-on retrofit devices, low emission non-catalytic woodstoves, and double wall flue pipe) under in-home conditions; measuring the creosote build-up in flue pipes and chimneys of the test stoves; comparing results from this study with other suitable studies; evaluating the impact of in-home woodburning operator practices on woodstove performance; evaluating the percentage of time catalysts were at lightoff conditions; and evaluating the effect on woodstove performance and particulate emissions of using the two types of wood commonly available in Whitehorse area (firekilled lodgepole pine, and seasoned white spruce). Nine one-week particulate emission sampling periods were conducted in 14 homes, half the time using the conventional woodstove and half using the new appliances. Results and user comments are given for each of the new technologies, as well as the conventional appliances. 14 refs., 15 figs., 42 tabs.

35866 (NME–1986, pp. 81-88) **Woodchip production and transporation in Newfundland. Overview.** Strong, W. (Highlands Contracting Ltd., Gander, NF, Canada). Mercy Hospital and Medical Center, Chicago, IL (USA). 1986. (CONF-8611290–: Wood and peat energy conference, Gander, Canada, 17-19 Nov 1986;MICROLOG–89-01972). In *The power of alternative. Energy from wood and peat.* Available from Dept. of Mines and Energy, PO Box 4750, St. John's, NF, Canada A1C 5T7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Wood chip production began in Newfoundland in 1978 with the trial of the Morbark 22 Chiparvester at Price Newfoundland Ltd. (now Abititbi-Price). Approximately 7,000 tonnes were produced. That operation has not stopped production, but many changes have been made. Since then, several other consumers have started to use wood chips as a source of fuel. The names and yearly capacities of present woodchip users are as follows: Abitibi-Price (Grand Falls), 50,000 tonnes; Corner Brook Pulp and Paper, 25,000 tonnes; Gander Hospital, 3,200 tonnes; Nfld. Hardwoods, 5,000 tonnes; 1985 total, 83,200 tonnes. 1 fig.

35867 (NME–1986, pp. 43-55) **Wood-fired boiler feasibility study. Western Memorial Regional Hospital Corner Brook, Newfoundland.** McDougall, A.R. (ShawMont Newfoundland Ltd., St. John's, NF, Canada). Mercy Hospital and Medical Center, Chicago, IL (USA). 1986. (CONF-8611290–: Wood and peat energy conference, Gander, Canada, 17-19 Nov 1986;MICROLOG–89-01972). In *The power of alternative. Energy from wood and peat.* Available from Newfoundland. Dept. of Mines and Energy, PO Box 4750, St. John's, NF, Canada A1C 5T7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The purpose of this report is to investigate the economic feasibility of converting to a wood fuel energy source, and to develop a preliminary design of a wood fired heating system based on system information proposed by equipment manufacturers. Energy requirements are discussed. The peak load at the hospital is 7.3 MW, however, this seldom occurs. There are two approaches that may be taken in selecting and sizing a wood-fuel heating system. The first method is to select a system with sufficient capacity to meet the highest anticipated load requirement. The second approach is to undersize the wood fired system, thus requiring an auxiliary system. Preliminary design, wood availability and cost are discussed; the choice is made to burn wet woodchips with an assumed cost of $34/ton. In spite of the sharp drop of oil prices, the true payback period of the new installation is 8 years. It is recommended that the base load system be installed as indicated in the preliminary design; it is also recommended that the installation be made under a single turn-key type arrangement with an equipment supplier. 2 figs., 2 tabs

35868 (NME–1986, pp. 19-28) **Woodchip conversion project report. Newfoundland Hardwoods Clarenville plant and Clarenville district vocational school.** Mills, M. (Acres International Ltd., St. John's, NF, Canada). Mercy Hospital and Medical Center, Chicago, IL (USA). 1986. (CONF-8611290–: Wood and peat energy conference, Gander, Canada, 17-19 Nov 1986;MICROLOG–89-01972). In *The power of alternative. Energy from wood and peat.* Available from Dept. of Mines and Energy, PO Box 4750, St. John's, NF, Canada A1C 5T7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

For the Newfoundland Hardwoods Clareville plant, the design of the new boiler system and tender call were carried out in 1983, with the project completed in September 1984. The operation consists of a fuel dump station, a chip screen, a fuel storage and a new 2.94 MW completely automatic Bell boiler capable of producing 454 kg/h of steam by burning whole tree chips with a moisture content of 45%. The total project cost, including engineering, was $587,500, with anual savings of $120,000. The shared financing of this project is discussed. On the other hand, a 0.294 MW system was designed, for the Clareville District Vocational School, where the boiler, controls and fuel storage were completely enclosed in a portable building with the fuel dump station as a separate add-on package. In the design of the boiler, which was to be low pressure hot water, the daily use and peak loads were taken into consideration. The few data available since delivery in late 1985 indicate a saving over oil in the range of 40%. The shared financing of this project is also discussed. Recommendations are made for future systems. 3 figs.

35869 **Glucose yields from the solvolysis of wood and pure cellulose by anhydrous Hydrogen Fluoride vapor.** Rorrer, G.L. (MSU-DOE Plant Research Lab., Michigan State Univ., East Lansing, MI (US)); Ashour, S.S.; Hawley, M.C.; Lamport, D.T.A. v.v of Energy from biomass and wastes XI. Klass, D.L. Institute of Gas Technology, Chicago, IL (1988). (CONF-870364–: 11. IGT conference on energy from biomass and wastes, Orlando, Florida, USA, 16-20 Mar 1987).

The solvolysis of Bigtooth Aspen wood and pure cellulose (filter paper) by anhydrous Hydrogen Fluoride (HF) vapor was investigated. Each substrate was exposed to a 100% HF vapor stream at 1.0 atm and 27^{0}C to 77^{0}C for a given reaction time. The water-soluble reaction products were then post-hydrolyzed in 2 N trifluoracetic acid for 1 h at 121^{0}C. With this two-step hydrolysis, maximum glucose yields of 85% from wood and 94% from pure cellulose were obtained. HPLC analysis of the water-soluble reaction products obtained before post-hydrolysis revealed that glucose and glucosyl fluoride repolymerized to oligomers during vapor-phase HF solvolysis of cellulose. The oligosaccharide product distribution was dependent on reaction time, temperature, and sample water content.

0905 Liquid Waste Fuels

Refer also to citation(s) 36442

13 HYDRO ENERGY

35870 (OME–1988, pp. 7) **Build-operate-transfer concept. A case history from Turkey.** Portfors, E.; Lampa, J.; Even, F. Ontario Ministry of Energy, Toronto, ON (Canada). 1988. (CONF-880711–: Small hydro '88: international conference and trade show, Toronto, Canada, 4-9 Jul 1988;MICROLOG–89-02657;CE–02581). In *Small hydro '88. An international conference and trade show. Proceedings, vol. 2.* Available from Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Turkey has recently found a solution to the problem of investment financing called the Build-Operate-Transport (BOT) formula. It

involves foreign entrepreneurs taking a share in a company established to build and operate a project. The entrepreneurs will be able to repatriate outstanding loan repayments, including their share of earnings from equity holdings. Once the loans have been repaid, the joint venture is dissolved and the ownership of the facility is transferred to the host government or public utility, which continues its operation. The Tortum 2 hydroelectric project in northeastern Turkey is described. A head of 87 m was developed. During the feasibility study, several improvements were implemented. The installed capacity was reduced from 18 MW to 11 MW, with two 5.5 MW vertical shaft Francis turbines. This maximized the return on investment, as the third unit in the 18 MW scheme had a load factor of 0.35. Unfortunately, it is not until approximately the year 2000 that the required selling price will fall below the BOT guidelines' stipulated limit of 60% of the Turkish Electricity Authority selling price. 4 figs.

35871 (OME–1988, pp. 9) **Andhi Khola Hydel and Rural Electrification Project (AHREP) Nepal. Low cost hydropower with maximum local training.** Francis, M. Ontario Ministry of Energy, Toronto, ON (Canada). 1988. (CONF-880711–: Small hydro '88: international conference and trade show, Toronto, Canada, 4-9 Jul 1988;MICROLOG–89-02657;CE–02581). In *Small hydro '88. An international conference and trade show. Proceedings, vol. 2.* Available from Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

AHREP is a project of United Mission to Nepal financed by Norwegian Government Aid under agreement with the Government of Nepal. Construction began in 1983 and is due to be finished in 1990. High speed of construction was not one of the objectives of the project; it was considered more important to use local resources and to implement the project in such a way that it could be replicated elsewhere in Nepal. The capacity of the power plant is 5 MW. Because of the long loop of the Andhi Khola river, the power plant is able to exploit a head of 250 m. It is a run of the river plant with daily storage to be provided during the dry season. Water is taken off through a side intake with undersluice into a gravel trap, then via an open canal to a sand trap; the 1.3 km long headrace tunnel takes water through the 300 m high ridge dividing the valleys of the Andhi Khola and Kali Gadaki valleys; the penstock runs in a vertical shaft which also provides access to the underground powerhouse, and the 1 km long tailrace tunnel discharges water form the powerhouse into the Kali Gadaki. Rural electrification is an important aspect of the project as are the promotion of forestry and other rural industries and the production of drinking water. Water from the headrace tunnel will also provide irrigation of up to 300 ha. Almost all of the electromechanical equipment has been obtained from Norway. The project will be connected to the national grid by a 33 kV, 20 km long transmission line including spans of up to 800 m to cross the deep gullys. The cost is $782/kW, lower than any other hydro plant in Nepal. 1 fig., 2 tabs.

1301 Resources and Availability

35872 (AD-A–204796/7/XAB) **National Hydroelectric Power Resources Study. Volume 12.** Army Inst. for Water Resources, Fort Belvoir, VA (USA). Sep 1981. 829p. (IWR–82-H-12). Available from NTIS, PC A99/MF E04.

This report contains a National Summary of selected, site-specific, data contained in the NHS regional reports and includes hydropower projects which have no apparent potential for economic hydropower additions. Selected site by site data are arranged by state, county, and project name in Appendix C. The text discusses inventory stages, analytic procedures, and study sequence.

35873 (EC/IWD–1988) **Quebec surface water data, 1987.** Environment Canada, Ottawa, ON (Canada). Inland Waters Directorate. 1988. V (MICROLOG–89-00807). Available from Water Survey of Canada, Place Vincent Massey, 351 St. Joseph Blvd., Ottawa, ON, Canada K1A 0E7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Data are presented for water levels of rivers and lakes in Quebec for 1987. The data were collected by hydrometric surveys conducted by the Water Survey of Canada and assisted by other federal, provincial and private bodies such as Hydro-Quebec and the provincial environment ministry. Information presented in this report also includes summaries of monthly and annual data, daily discharge, and descriptive information relating to the gauging station, such as type of gauge, location, drainage area, and whether the flow is natural or regulated. 57 tabs.

35874 (OME–1988, pp. 19) **Small hydro in Canada, 1988.** Fawkes, P. (Patrick Fawkes and Associates, Vancouver, BC, Canada). Ontario Ministry of Energy, Toronto, ON (Canada). 1988. (CONF-880711–: Small hydro '88: international conference and trade show, Toronto, Canada, 4-9 Jul 1988;MICROLOG–89-02657;CE–02581). In *Small hydro '88. An international conference and trade show. Proceedings, vol. 2.* Available from Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This paper presents an overview of present activity in small hydro (less than 15 MW) in Canada, and comments on the prospects for future small hydro development. There are presently more than 327 small hydro plants with a total peak capacity of 1000 MW; 6 more plants with a total capacity of 56 MW are under construction or committed for construction by the end of 1989. The paper lists presently operating plants and 20 selected projects which are presented in more detail. The potential for small hydro sites less than 10 MW has been estimated at 2000 MW at more than 1000 sites. Government supported demonstration projects (presently 21 in number) and research and development (11 contracts in 1986, 13 more in 1987) are discussed. Other factors affecting the development of small hydro power are the dissemination of information and private power producers associations. Two surveys of the Canadian small hydro industry have been achieved recently. In both cases, the US market was found to be the most important. This overview of the small hydro scene in Canada indicates that a modest industry exists which is capable of meeting present and expected levels of activity, it will grow when more provincial power utilities offer private power producers purchase rates which allow these producers to profit.

1303 Plant Design and Operation

35875 (EPRI-GS–6419-Vol.3) **Hydropower plant modernization guide: Volume 3, Automation: Final report.** Froehlich, D. Electric Power Research Inst., Palo Alto, CA (USA); Black and Veatch/Motor Columbus, Associates, Kansas City, MO (USA). c Jun 1989. 135p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The Automation Guide provides a procedure and associated information to enable utility personnel to identify which hydroelectric plants on their system are potentially suitable for the cost-effective implementation of automation. The guide provides screening criteria to make an initial assessment of plant suitability. A Feasibility section describes all the functional systems of a typical plant that should be considered for conversion to automatic operation. The instrumentation and other equipment that would be required by each of these systems are discussed and ranges of cost estimates are given. The guide addresses automation requirements suitable for either semi or fully-automatic, remotely controlled, unmanned sites, but sufficient information and detail are provided to allow the guide user to modify those approaches for specific plants. A brief but comprehensive section on economic evaluation methods is included. Worked examples of conversions of typical systems to automation demonstrate the use of the techniques and data. 30 figs., 18 tabs.

1305 Economics and Management

Refer also to citation(s) 35875, 35884, 35885, 35886, 35888, 35889, 35891, 35892, 35893, 36224, 36225, 36230

1306 Environmental Aspects

35876 (DOE/BP/24238–2 I.1.1-I.1.21) **Systems analysis and the fish and wildlife program.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

In simple terms, systems analysis can be defined as a body of theory and analytical techniques which are designed to assist policy makers in choosing among options. Two of the more useful tools of systems analysis are modeling, in which complex systems are represented by abstractions, and simulation, a process in which one tries to better understand system behavior and to anticipate potential future impacts of management actions by constructing and experimenting with various computer models. When used correctly, systems analysis can be a vital component of the decision-support systems used in natural resource management. The role of systems analysis within the framework of the Fish and Wildlife Program is the focus of this chapter, which begins with a discussion of the general use of modeling to support management and research. This report outlines an approach to modeling the salmon and steelhead fisheries of the Columbia River Basin with special reference to the impact of the hydroelectric system.

35877 (DOE/BP/24238–2 I.2.1-I.2.10) **Overview of models.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

The purpose of this chapter is to present an overview of the types of models needed to support management of the fisheries of the Columbia River Basin and the application of these models. Most of the preliminary ecological modeling work that has been completed at RFF during this phase of the research effort has focused on the life-stanza models. There are two reasons for this emphasis. First, it is within the life-stanza models that causal links between mitigation measures and biological responses must be specified at a relatively fine level of resolution. This requires a close inspection of the biological impacts of management actions on fish which goes beyond demonstrating that an empirical relationship exists between variables. Since the conditions under which such a relationship was produced may change, it is also important to understand how an empirical result might arise as a function of physical and biological processes. Only by understanding causal relationships can one hope to plan an efficient Fish and Wildlife Program. The second reason for focusing on the life-stanza models is a perceived need to examine particular components of the life cycle which have not received the attention they deserve. Opportunities for enhancing fish production in the Columbia Basin at a minimal cost or effort may be lost simply because they escape consideration.

35878 (DOE/BP/24238–2 I.3.1-I.3.8) **Juvenile production.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

A central feature of the Fish and Wildlife Program is the effort to bolster production of juvenile salmon and steelhead in the Columbia River Basin, as measured by both the quantity and quality of smolts. The present natural production of the Columbia system is a small fraction of the estimated production in predevelopment times. Part of this loss can be attributed directly to hydrosystem development which inundated spawning and rearing habitat, increased downstream passage mortality, and blocked passage of adult fish returning to spawn. Other factors such as agriculture, timber harvest, and urban development have also contributed to production losses through environmental degradation. Historically, the dominant means of mitigating production losses has been the use of hatcheries. Present efforts to increase production levels include a combination of both natural and artificial production methods, including using hatcheries to produce fry which are then released in natural streams for rearing. Additional measures which have been implemented or are proposed for the Columbia River Basin include the construction of additional artificial production facilities, water management schemes to provide suitable instream flows for naturally spawning fish, and studies to aid in the detection, diagnosis, and control of fish diseases and parasites.

35879 (DOE/BP/24238–2 I.4.1-I.4.24) **Modeling downstream migration.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

Each year millions of young salmon and steelhead trout released from hatcheries or reared naturally in tributary streams throughout the Columbia River Basin begin a perilous journey to the Pacific Ocean. Hydroelectric development of the Columbia System has replaced the once free-flowing rivers encountered by these fish with a series of slow-moving reservoirs punctuated by run-of-river dams. The considerable impact of development and operation of these dams and upstream storage reservoirs on outmigrating juveniles is well documented and has prompted an extensive program of mitigation measures. An end result of hydrosystem development and operation is that smolts migrating from their headwater streams of origin are now faced with a passage that takes longer, is more physically taxing, and includes new sources of mortality, as compared to pre-development times. Models are needed which can help assess hydrosystem impacts and evaluate the relative effectiveness of potential management actions such as improvements in passage facilities, transportation, and providing increased flow for fish measures which are designed to improve survival through the system. The modeling approach described in this chapter focuses on the processes involved in reservoir passage. By emphasizing the reservoir passage component, this modeling approach should complement rather than supplant existing models.

35880 (DOE/BP/24238–2 I.5.1-I.5.37) **Modeling the estuary and early ocean life stanza.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

Each year, millions of juvenile anadromous salmon and trout pass through the Columbia River estuary on a journey to the Pacific Ocean where they grow to adulthood. For many of these salmonids, the relative success of the stock may be largely determined by the magnitude of the mortality incurred during their brief stay in the estuary or in the first few months following entry into seawater. Understanding of the mechanisms affecting survival and growth of juvenile salmonids in the estuary and near-shore oceanic environment is crucial to the effective management of these species. Fishery managers and those interested in salmonid enhancement in the Columbia River Basin face the challenge of identifying management actions that will enhance the prospects of marine survival of each stock. Despite a growing body of research on the Columbia and other Northwest estuaries, major uncertainties pervade our knowledge of critical ecological processes which affect salmonids during their estuary and early ocean (EEO) tenure. Where major uncertainties exist, a valid use of simulation models is to explore alternative hypotheses concerning causal mechanisms with the intention of identifying crucial da8ta needs. In order to demonstrate the utility of developing models of the EEO component for Columbia Basin Stocks, an example model has been construction which simulates the mortality and growth of a hypothetical chinook stock which enters the estuary as subyearlings. Mean length and mean time of arrival at the estuary can be adjusted to simulate the potential impacts of upstream management actions which affect these variables. Given the level of uncertainty surrounding our present

knowledge of marine ecological processes, the intent of the model presented here is to focus debate and refine understanding.

35881 (DOE/BP/24238–2 I.6.1-I.6.14) **Modeling the late ocean life stanza.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

Most of the research on the late ocean component of the salmon life cycle historically has focused on sport and commercial ocean harvest. But allocation of harvest is not the only issue of importance in the ocean fisheries. Ecological issues such as growth rates, size structure, and age at sexual maturity interact with harvest rates to influence the relative productivity and fitness of a stock. These interactions can be conveniently explored with simulation models. As an example, this chapter describes a model which allows one to address interesting ecological questions in addition to harvest. The example model presented here allows one to experiment with various combinations of growth rates, harvest rates, and mechanisms for determining the fraction of the population which matures each year (return schedules). Options are provided such that one can specify return schedules as a function of both age and size. Other models which have been applied to Columbia stocks do not permit this flexibility. Output from the model includes age and length distribution of returning adults. This output can be combined with external information including length-fecundity relationships to produce estimates of reproductive potential.

35882 (DOE/BP/24238–2 I.7.1-.7.25) **Modeling the upstream migration of adult salmonids.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

Hydroelectric development of the Columbia River Basin poses major obstacles for adult Pacific salmon and anadromous trout trying to return to their natal spawning areas. The dams which clog the mainstem Columbia River and its major tributary, the Snake River, effectively block or impair the upstream migration of fish. Dams which are not equipped with fish passage facilities, such as Chief Joseph and Hells Canyon, prevent anadromous fish from using large areas where natural spawning occurred historically. Downstream, run-of-river dams equipped with fish ladders have less obvious, but equally real, impacts. Poor design or inefficient operation of installed passage facilities can result in delay or mortality of migrating fish, thus reducing the numbers or fitness of adults reaching upstream spawning areas. In order to assess the chances of an individual making a successful spawning migration, one must estimate the likelihood of available energy reserves being sufficient to cover the energetic demands of the migration. Thus arises the three necessary parts of an upstream migration model: (1) an estimate of the variability in the migration paths (both time and distance) experienced by a stock; (2) an estimate of the caloric demand associated with each migration path; and (3) integration of (1) and (2) to provide an estimate of the energy reserves available for spawning within a stock and the distribution of those reserves among individuals.

35883 (DOE/BP/24238–2 I.8.1-I.8.37) **Smolt monitoring in the Columbia River Basin.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

The monitoring or counting of Columbia River Basin juvenile salmon and steelhead trout as they migrate to the sea from hatcheries and natural nursery areas has two principal objectives: (1) to keep track of the outmigration on a real-time basis in order to provide information to those responsible for manipulating streamflows and spills at dams, with the goal of increasing downstream passage survival; and (2) to permit assessment of the biological and cost-effectiveness of the several mitigation policies under consideration. Monitoring of the outmigration and evaluation of mitigation strategies will continue to be a major concern of fishery managers and researchers in the Columbia River Basin for some time. In this chapter, we have discussed some of the problems encountered in smolt monitoring and introduced some of the potential technological and statistical advances which may alleviate some of these problems. We believe that some of these problems can be resolved. However, their resolution will require a sound research design, a commitment on the part of fisheries managers and funding agencies, innovation and discipline of the part of researchers, and cooperation all around.

35884 (DOE/BP/24238–2 II.1.1-II.1.29) **Economic analyses of fish mitigation strategies.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

An attempt is made to report on methods for analyzing the cost and long-term fish production implications of alternative management strategies for improving the anadromous fisheries in the Columbia River Basin and for identifying cost-effective alternative means for achieving biological objectives ultimately to be specified by the Northwest Power Planning Council. Different types of cost-effectiveness analyses are presented and their applicability to the analysis of fish mitigation are assessed in the context of the Columbia River salmon and steelhead fisheries. The conditions are described that were assumed for the design and development of methods of cost-effectiveness analysis presented in this part. These conditions include the biological objectives for the fisheries to be established by the Council, the economic criterion used to compare mitigation alternatives, the types of costs included in the cost-effectiveness analyses, and the nature of the policy constraints imposed on the analyses. Three problem types likely to be encountered in assessing the cost-effectiveness of alternative mitigation strategies are described. The two cost-effectiveness models proposed for development are presented.

35885 (DOE/BP/24238–2 II.2.1-II.2.20) **Assessing the cost-effectiveness of alternative mitigation strategies: the simulation model.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

This chapter describes the principal elements and features of an economic-ecologic simulation model designed to assess the costs and the long-term fish production implications of alternative management strategies for enhancing the salmon and steelhead fisheries in the Columbia River Basin. The design of the model is based on the availability of an energy planning model for the Pacific Northwest, an hydrosystem simulation model of the Columbia River Basin, and an hydrosystem regulator that already exist in the region, and on a simulation model of the salmon and steel head fisheries to be developed in another part of this project. It is important to note that such a model has not actually been developed for the Columbia Basin but that what is discussed here is an outline of how such a model could be developed.

35886 (DOE/BP/24238–2 II.3.1-II.3.72) **Identifying the most cost-effective fish mitigation strategy: the least-cost model.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

The goal of this chapter is to identify the structure of a least-cost mathematical programming model and to estimate its size. Structure

and size are the two principal attributes of such models that influence their success in real applications. For large scale applications such as this, the most desirable model structure from a computational perspective is a linear programming (LP) model. In order to be able to use linear programming, through, all the cost functions and all the constraining relationships must either be linear or be approximated by linear segments. The purpose of this model is to assist in identifying system-wide least cost fish mitigation alternatives. Such a model is needed because it is unlikely that the least-cost alternatives or set of alternatives can be identified using the hydrosystem and fish simulation models. Nonetheless, this will not be achieved without considerable effort and without overcoming computational problems unique to the various optimization algorithms. These computational problems are due partly to model structure and partly to model size. The priority for model structure, based both on experience and on ease of application, has been ordinary linear programming (LP), mixed integer linear programming, and nonlinear programming, in that order. The mathematical development in this chapter has demonstrated that it will not be possible to construct a least-cost model for fish mitigation in the Columbia River Basin using ordinary linear programming (LP). However, at least in principle, it will be possible for construct a least-cost model using mixed integer linear programming.

35887 (DOE/BP/24238–2 II.4.1-II.4.15) **Feasibility of implementing the least-cost model.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

It has been demonstrated that the least-cost fish mitigation model will fit mathematically and conceptually into a mixed-integer linear programming framework. The conceptual model developed in there is extremely large, for two reasons. First, the number of stocks, reservoirs, dams, and mitigation alternatives is enormous, since the Columbia basin is a very large and diverse region. Second, it is likely to take several salmonid generations for the stocks in the region to double in size. The size of the proposed least-cost model poses two problems with respect to actually constructing and solving the large system of equations. The first concerns the data requirements for the model. The amount of information needed to construct the model is very large, and it seems likely that there will be difficulties with both finding the requisite primary data and generating the coefficients required to solve the least-cost model in any type of mathematical programming framework. Even if the data needed were readily available in an easily usable form, and there were no uncertainty associated with the phenomena being modelled, however, other problems would remain. This category can be described as analytical problems. It includes the mathematical and computational feasibility of solving any large model where iterative solution methods are required to find a solution which minimized (or maximizes) an objective function and simultaneously meet an exogenous set of constraints. The remainder of this chapter attempts to show the major causes of the problems, and suggests some possible ways to address the analytical issues involved. It ends by concluding that the analytical problems caused by the large size of the least-cost model may be solvable, using matrix decomposition techniques.

35888 (DOE/BP/24238–2 II.5.1-II.5.39) **Assessing the opportunity cost of fish mitigation activities in the Columbia River Basin.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

This chapter examines a variety of methods for assessing the opportunity costs of fish mitigation activities. It is specifically concerned with the opportunity costs associated with irrigation and hydropower. In the case of irrigation, we assume that a water rights market exists in the region, such that farmers could buy and sell rights to irrigation water. Although such rights markets are in use elsewhere in the Western states, no markets for irrigation water are presently in operation in the Pacific Northwest. While we do not advocate the establishment of such markets, previous work in the area suggests that both farmers and electricity consumers might both be made better off if in fact such markets were to function. The fact that irrigation withdrawals have been established to be important factors limiting fish production in some subbasins in the region, including the Yakima and Umatilla, suggests that reduction of irrigation withdrawals might well be a cost-effective means for enhancing fish runs. The work in this chapter should be viewed as steps toward developing a means for establishing the difference in costs between enhancing fish runs with and without an active water rights market, in which rights might be acquired for enhancing fish runs. It should not be taken as advocacy of establishing such markets.

35889 (DOE/BP/24238–2 II.6.1-II.6.10) **Data needs for proposed pilot study.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

Data are presented that would be needed for a pilot study of a subbasin. These data will be used to develop an economic-ecologic simulation model designed to assess the costs and the long-term fish production implications of alternative management strategies for enhancing the salmon and steelhead fisheries in the Columbia River Basin. In addition, the data will be used to develop a least-cost model to assist in identifying system-wide least cost fish mitigation alternatives. Data needs for the develop of the economic-ecologic simulation and least-cost models are organized into four groups. They are: hydrosystem data; fish life-cycle data; direct costs of fish mitigation alternatives; and opportunity costs of fish mitigation alternatives.

35890 (DOE/BP/24238–2 III.1.1-III.1.8) **History of the Columbia River salmon fisheries.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

In order to understand the current fisheries based on Columbia River salmon stocks, it is important to have a general historical perspective of how the fisheries evolved over time. We likely tend to think of the commercial and recreational exploitation of Columbia River stocks as a relatively recent - i.e., 19th and 20th century - development. However, native Americans fished for both commercial and sport purposes and utilized the salmon stocks of the Columbia River hundreds of years ago.

35891 (DOE/BP/24238–2 III.2.1-III.2.29) **Mathematical programming models of the ocean salmon fishery.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

Mathematical programming offers a potentially attractive way to model the bio-economics of the ocean fishery for salmon. It also provides a means to explore the effect of different management alternatives on these relationships. Formally, the mathematical programming model is a constrained-optimization problem that is stated in terms of single-valued continuous differentiable functions. This type of model offers limited opportunities to consider stochastic elements of the fishery problem. However, it has the potential capability of handling large variable set and possesses other attributes which enhance its desirability as a way to quantitatively represent the ocean salmon fishery. In the following, we will discuss how mathematical programming might be applied to the salmon ocean fishery problem. We shall also assess the pros and cons of some alternative formulations for this class of models, and propose a particular

formulation which we believe strikes a reasonable balance between ease of computation, flexibility of use and richness of results. The assumptions necessary to develop this type of model are specified, and its desirability as a way to model the fishery is evaluated.

35892 (DOE/BP/24238–2 III.3.1-III.3.39) **Procedures for valuing changes in ocean salmon stocks.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

This chapter describes various approaches for measuring the economic value of harvesting enhanced Columbia River salmon stocks. Such values are necessary to mathematical programming model as well as being of interest in their own right.

35893 (DOE/BP/24238–2 III.4.1-III.4.9) **Determination of economic impacts.** USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Resources for the Future, Inc., Washington, DC (USA). Dec 1988. In *Design of studies for development of Bonneville Power Administration fish and wildlife mitigation accounting policy. Phase 2, Final report: Volume 2, Technical reports.* Order Number DE89007411/JAW. Available from NTIS, PC A24/MF A01.

The benefits associated with decisions related to Columbia River fishery stocks have been discussed at a highly aggregated level. Analytical approaches to estimating these aggregate benefits have attempted to assess the sum total of the direct economic benefits that various decisions and actions imply, regardless of how the benefits and costs are distributed. However, such approaches may paint only partial pictures of the economic impacts of a decision. Numerous secondary benefits may be realized by activities which either provide inputs to or use the outputs of the commercial or recreational fishing sectors. For example, a large increase in the number of recreational fishermen that visit a harbor town may increase the sales of the restaurants in that town. Furthermore, an aggregate approach usually fails to investigate the income and employment impacts that states, local communities, or specific groups of individuals may experience. Decisions which may appear to yield positive economic benefits on an aggregated national level, for example, could affect specific local communities or groups negatively, and vice-verse.

35894 (GAO/RCED–88-60) **Energy regulation.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1988. 42p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

The Federal Energy Regulatory Commission conducts physical inspections of projects in accordance with its established procedures and monitors correction of any identified problems. Because of ineffective controls, however, FERC's monitoring of compliance with items required by the licenses and exemptions, such as emergency action plans and dam safety reports, does not always result in timely and consistent follow-up of overdue items. Furthermore, because of inaccurate data, FERC's computerized tracking system is of limited use as a tool.

35895 (MEW/WS–88-5) **Water chemistry/water discharge relationships within the Churchill River diversion and Lake Winnipeg regulation region, Manitoba, Canada.** Duncan, D.A.; Williamson, D.A. Manitoba Dept. of Environment and Workplace Safety and Health, Winnipeg, MB (Canada). Water Standards and Studies Section. 1988. 65p. (MICROLOG–89-00886). Available from Manitoba Legislative Library, 200 Vaughan St., Winnipeg, MB, Canada R3C 1T5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Hydroelectric power development in northern Manitoba has led to the diversion of the Churchill River and the regulation of Lake Winnipeg water levels. As part of an ecological monitoring program, statistically significant linear relationships were found between a number of water chemistry parameters and discharge at various sites within the diversion and regulation region. Linear relationships that were similar and present both before and after development are most useful for providing corroborative evidence that water chemistry changes are coincident with development. These relationships are also beneficial in assisting focus of future field activities related to water chemistry impacts. Such relationships were observed for the parameters conductivity, alkalinity, Ca and Cl- in the Burntwood River at Thompson, total P in the Churchill River upstream of Granville Lake, and conductivity and Ca in Littie Playgreen Lake near Norway House. Numercus relationships between water chemistry parameters and discharge have been significantly altered likely as a consequence of development. These relationships provide direct evidence that changes occurred within the system, but can only be used for indirect corroboration of previously identified water chemistry changes associated with development. Relationships that were statistically significant after development might be used cautiously to predict potential changes in water chemistry coincident with future alterations in discharge. Such relationships occurred for a number of parameters at most sites. Other parameters were not linearly related with discharge during either the pre-development or post-development period. 9 refs., 27 figs., 10 tabs.

35896 (MEW/WS–1987) **Canada-Manitoba agreement on the study and monitoring of mercury pollution in the diversion system of the Churchill River. Summary report.** Manitoba Dept. of Environment and Workplace Safety and Health, Winnipeg, MB (Canada). Water Standards and Studies Section. 1987. 95p. (In French). (MICROLOG–89-00509). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Lake Winnipeg, Churchill-Nelson River Hydroelectric Project in northern Manitoba includes river diversions that resulted in extensive areas of flooded terrain. Elevated mercury levels in fish from lakes along the diversion were noted, and concern for the possible health and economic impacts has led to a federal-provincial agreement to study the problem. There was no indication of elevated levels of natural Hg, and no evidence of important man-made sources. Methyl mercury, the predominant form of mercury in fish, is produced naturally in aquatic environments in small amounts by bacterial methylation. Studies done under the agreement found that net methylation rates were highest in the flooded areas, and that there was a high correlation between methylation rates and mercury levels in fish. It was also known that the most important factor affecting those rates is the amount and type of flooded organic material. At least in the case of moss-peat material, a doubling of the amount of this material resulted in a doubling of mercury accumulated in fish. It was also found that a wide variety of organic materials could stimulate the bioaccumulation of mercury in fish, indicating that the effect of flooding on mercury levels in fish is a general response. Another important factor is the amount of oxygen present; very low oxygen levels mean higher net methyl mercury production. The overall results of the agreement and other recent studies indicate that elevated mercury levels in fish following impoundment is a widespread problem that must be taken into account when planning future impoundment or reservoir projects. Includes glossary. 3 refs., 40 figs., 14 tabs.

35897 (TVA/WR/AB–89/6) **Results of fisheries investigations in Douglas tailwater, August 1987–September 1988.** Tomljanovich, D.A.; Saylor, C.F. Tennessee Valley Authority, Norris, TN (USA). Aquatic Biology Dept. May 1989. 45p. Order Number DE89014510/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

Releases from Douglas Dam during July, August, and early September are characterized by low dissolved oxygen (DO), increased hydrogen sulfide, and until fall 1987, no minimum flow. Studies are underway to improve water quality in the tailwater. A five-year minimum flow demonstration began October 1, 1987. To achieve a 300 cfs minimum flow at Saffell Island, 2.5 river miles downstream from Douglas Dam, one turbine in the 3200 to 4000 cfs range is pulsed for 35 to 45 minutes every four hours. In addition to minimum flow, surface water pumps and oxygen diffusers in front of the hydro unit intakes are being evaluated as ways to increase DO in the tailwater. During this five-year demonstration water quality monitoring and biological investigations will document changes and responses to increased minimum flow and improved water quality.

Objectives of the biological investigations are to document: (1) changes, characteristics, and diversity of the fish community of the tailwater using the Index of Biotic Integrity (IBI), (2) spawning locations and movement patterns of sauger in the tailwater, (3) reproduction of sauger and other species in the tailwater, and (4) fisherman distribution and creel throughout the tailwater. 10 refs., 3 figs., 16 tabs.

35898 (TVA/WR/WQ–89/1) **Pilot program for water quality data collection by volunteers.** Technical report series. Butkus, S.R. Tennessee Valley Authority, Chattanooga, TN (USA). Water Quality Dept. Mar 1989. 47p. Sponsored by Tennessee Valley Authority. Order Number DE89014508/JAW. Available from NTIS, PC A04/MF A01 - OSTI.

Like other water resource agencies elsewhere in the nation, TVA is now receiving increasing demands to provide more information about water quality in many areas of the Tennessee Valley, usually with little or no provision for increased staff or budget. In response to this challenge, TVA in 1988 began a pilot program to assess the value of using citizen volunteers to monitor selected water quality characteristics on Chickamauga Reservoir and to determine the feasibility of establishing a network of such volunteers throughout the Tennessee Valley to collect water quality at locations that are not now being sampled frequently or regularly. TVA provided the necessary equipment and trained volunteers to use it properly. The volunteers donated their time to make observations and measurements that expanded the available database.

35899 (TVA/WR/WQ–89/2) **Measurement of upwelling flow from Upper Bear Creek reservoir air diffusers.** Brown, R.T.; Gordon, J.A. Tennessee Valley Authority, Knoxville, TN (USA). Water Quality Dept. May 1988. 42p. Sponsored by Tennessee Valley Authority. Order Number DE89014507/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

Field tests were performed to determine the upwelling flow from the air diffusers located in Upper Bear Creek reservoir. The diffusers were installed in an effort to maintain aerobic conditions throughout the water column, so that the reservoir and hence low level summer releases would not contain high concentrations of dissolved iron, manganese, and sulfide. Three tests were conducted using one diffuser, at the normal air flow rate of 0.012 m^3/sec (25 scfm), at an increased air flow rate of 0.024 m^3/sec (50 scfm) and at reduced air flow rate of 0.006 m^3/sec (12.5 scfm). The upwelling from the air diffuser was dyed with Rhodamine WT and concentrations in the flow away current were measured to estimate the total upwelling flow. Velocity measurements obtained in the flow away current provided a second estimate of the upwelling flow. These field estimates at the Upper Bear Creek diffuser were compared with equations found in the literature. The measured Upper Bear Creek diffuser upwelling flow was greater than these equations predicted, although the general magnitude was confirmed. 18 refs., 5 figs., 3 tabs.

14 SOLAR ENERGY

Refer also to citation(s) 36370

1403 Economics

Refer also to citation(s) 35932

1405 Solar Energy Conversion

Refer also to citation(s) 35862, 35864, 35868, 37206, 37212, 37336, 37337

35900 (CFS/NF–8710) **Proceedings of the workshop on aspen pulp, paper and chemicals.** Wong, A. (ed.); Szabo, T. (ed.). Canadian Forestry Service, Edmonton, AB (Canada). Northern Forest Research Centre. 1987. 260p. (CONF-8710145–: Biochemical conversion program annual review meeting, Golden, Colorado, USA, 13-15 Oct 1987;MICROLOG–89-01396). Available from Northern Forestry Centre, 5320 - 122 Street, Edmonton, AB, Canada T6H 3S5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A workshop was held in Alberta to communicate research results related to improved utilization and development of provincial forest resources, notably aspens. This species comprises about 40% of Alberta's total wood volume, and only about 10% of this resource is utilized. Papers were presented on various means of utilizing aspens (and other trees such as birches), mostly for pulp production in the paper industry. Also considered were production of alcohol fuels and chemical byproducts. Separate abstracts have been prepared for two papers from this workshop.

35901 (DOE/CE/15270–T10) **Explorations of mechanisms regulating ectomycorrhizal colonization of boron-fertilized pine: Quarterly report, April 1,1989–June 30, 1989.** Garrett, H.E.; Begonia, G.; Sword, M.A. Missouri Univ., Columbia, MO (USA). School of Forestry, Fisheries and Wildlife. 1989. 13p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG01-86CE15270. Order Number DE89014452/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The present study examines the effects of foliar boron fertilization and inoculation with an ectomycorrhizal fungus (Pisolithus tinctorius) on ^{14}C-photosynthate partitioning to various tissues of shortleaf pine seedlings, placing special emphasis on the ^{14}C distribution to the root systems. Specifically, the hypotheses to be tested are: (a) ^{14}C allocation to the root systems will increase with inoculation, and (b) ^{14}C partitioning will be enhanced by foliar boron application.

35902 (DOE/OR/21390–T25) **Biomass energy facilities: 1988 Directory of the Great Lakes region.** Council of Great Lakes Governors, Chicago, IL (USA). Great Lakes Regional Biomass Energy Program. 1988. 941p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG05-83OR21390. Order Number DE89014798/JAW. Available from NTIS, PC A99/MF A01 - OSTI; GPO Dep.

In order to introduce and encourage private sector use of the vast renewable resource in the Great Lakes region, the Great Lakes Regional Biomass Energy Program has produced this directory of biomass energy systems. The directory, which was compiled with the assistance of the state biomass energy agencies in the region, documents the many firms and institutions utilizing biofuels. It is hoped that the detailed information on each facility will be useful to persons and organizations considering investments in bioenergy systems. The directory is divided into five sections covering the most common biofuel systems found in the region: (1) alcohol production, (2) crop residue combustion, (3) methane production, (4) waste-to-energy, and (5) wood combustion. In each section the facilities are grouped by state. The state subsections are presented alphabetically, and within each state the facilities are listed in alphabetical order by organizational name. Independent School Districts (ISD) in Minnesota are arranged alphabetically by the name of the town in which they are located. Preceding each state subsection, there is a map showing the distribution within the state of that type of biomass facility. 12 refs.

35903 (ETDE-mf–9788279) **Microbiological investigations on nitrification in waste water treatment plants with fixed sludge beds. Pt. 2. Pilot scale test. Final report.** Dengler, D.; Eberhardt, H. Institut fuer Umweltanalytik und Biotechnologie G.m.b.H., Pforzheim (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Dec 1988. 48p. (In German). Order Number DE89788279/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The effluent of the settling tank of a waste water treatment plant was enriched with additional ammonium for the purpose of further nitrification. At the initial stage nitrifying enrichment cultures from the laboratory were added. The long generation times and the small growth rates of nitrificants proved to be obstructive for a pilot scale application. Installations of fixed sludge beds (BIO-NET) in the reactor led to enrichment cultures with ammonium containing waste water without additional inoculation. The content of nitrificants and the population of nitrificants in the reactor, at the wall and upon the fixed beds was determined by means of fluorescence microscopy and by flow cytometry. The part of the genus Nitrosomonas in the reactor was 10%, that is 2-3 times more than it is in the aeration tank of a waste water treatment plant. (orig.) With 11 refs., 4 tabs., 28 figs.

35904 (FCC–8801) **Steam pretreatment of wood in relation to enzymatic hydrolysis. Final report.** Forintek Canada Corp., Ottawa, ON (Canada). 1988. 183p. (MICROLOG–89-00766). Available from Forintek Canada (Ottawa), Montreal Rd., Ottawa, ON, Canada K1S 0W5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The effects of variables in steam pretreatment of aspenwood (temperature, time, moisture content and SO_2 catalysis) have been determined, with and without explosion, on the resulting composition and enzymatic hydrolysis. Combination treatments (steaming + wet-milling, or steaming + H_2O_2 treatment) further increase accessibility. Results show that accessibility is not increased by explosion, but is increased by hydrolysis of both xylan and lignin, and by H_2O_2 oxidation of lignin. Accessibility correlates well with content of residual alkali-insoluble lignin (the most important factor), but not with total residual lignin, and not with xylan. Free alkali-soluble lignin has no effect. H_2O_2 increases accessibility by reducing the content of alkali-insoluble lignin, which presumably restricts cell-wall swelling. SO_2 catalysis increases hydrolysis relative to undesirable pyrolysis and xylose destruction. Variables (ratio of wood/gum volume, SO_2/wood, temperature, time and moisture content) have been studied, and further improorvements by H_2O_2 measured. Analytical methods for substrates and enzymatic hydrolysates are discussed, and the reason for discrepancies shown. Improved high pressure liquid chromatography methods for enzyme assay are reported. Crystallinity is not decreased by steam treatment, with or without explosion. 31 refs., 29 figs., 34 tabs.

35905 (ORNL/TM–11054) **Bioprocessing research for energy applications.** Scott, C.D.; Gaden, E.L. Jr.; Humphrey, A.E.; Carta, G.; Kirwan, D.J. Oak Ridge National Lab., TN (USA). Apr 1989. 207p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. (CONF-8811104–Summs.: Meeting on bioprocessing research for energy applications, Alexandria, VA, USA, 2-4 Nov 1988). Order Number DE89013735/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The new biotechnology that is emerging could have a major impact on many of the industries important to our country, especially those associated with energy production and conservation. Advances in bioprocessing systems will provide important alternatives for the future utilization of various energy resources and for the control of environmental hazards that can result from energy generation. Although research in the fundamental biological sciences has helped set the scene for a "new biotechnology," the major impediment to rapid commercialization for energy applications is the lack of a firm understanding of the necessary engineering concepts. Engineering research is now the essential "bridge" that will allow the development of a wide range of energy-related bioprocessing systems. A workshop entitled "Bioprocessing Research for Energy Applications" was held to address this technological area, to define the engineering research needs, and to identify those opportunities which would encourage rapid implementation of advanced bioprocessing concepts.

35906 (PB–89-172225/XAB) **Marine biomass: New York State species and site studies. Annual report December 1982-November 1983.** McKay, L.B. New York Sea Grant Inst., Albany, NY (USA). Nov 1983. 229p. Available from NTIS, PC A11/MF A01.

See also PB–85-113462.

The Energy Authority has been conducting tests since 1979 in an effort to develop a feasible system for the production in Long Island Sound of marine biomass from indigenous macroalgae for economically competitive conversion to synthetic natural gas. During 1983 this goal was brought closer to realization when a 120 x 41 foot seaweed test farm was placed in 60 feet of water in Long Island Sound. The structure is basically a flexible wire cable and rope grid, buoyed at the surface and moored to the bottom of the Sound. It is suitable for cultivating seaweeds that attach themselves to surfaces such as the brown kelp, Laminaria saccharina. The test farm design was chosen from among four previously developed by the engineering team. An ongoing program is taking place in Long Island Sound to test the strength of the structure and to obtain information on plants growing in the structure. The program will test the strain on the lines, corrosion on metal parts, and available light and temperature at various times. Also, since 1982, bioengineering tests have focused on biofouling experiments, and seaweed and rope strength tests. The report also includes discussion of a laboratory research program focused on seeding techniques and strain selection.

35907 (PNFI–PI-X-85) **Theory and methodology of single tree volume estimation.** Titus, S.J.; Morgan, D.J. Institut Forestier National de Petawawa, Chalk River, ON (Canada). 1988. 33p. (In English and French). (MICROLOG–89-01030). Available from Petawawa National Forestry Institute, Library, Forestry Canada, Chalk River, ON, Canada K0J 1J0; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The purpose of this paper is to summarize current knowledge about major relationships used to predict individual tree bole volumes. The theory of tree volume relations is discussed, based on the modelling of the main stem (bole) as a cone. Evaluation of tree volume relations is then outlined, considering population specifications, sampling methods, measurement procedures, and curve fitting (regression analysis). Finally, the use of tree volume relations is described, including the use of existing volume relationships, extrapolation, and adjustment of existing volume relationships in new applications. 15 refs.

35908 (SERI/CP–213-3495) **Photovoltaics advanced research and development: 9th annual review meeting.** Solar Energy Research Inst., Golden, CO (USA). 1989. 122p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-890533–Absts.: 9. SERI photovoltaic advanced research and development project review meeting, Lakewood, CO, USA, 24-26 May 1989). Order Number DE89000895/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This paper contains a list of abstracts of papers presented at the conference. Topics covered include: thin film technology; fundamental research; and measurement and characterization techniques. (JEF)

35909 (SERI/SP–220-3366) **Biofuels technical information guide.** Solar Energy Research Inst., Golden, CO (USA). Apr 1989. 198p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89000894/JAW. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

This guide combines an overview of the biofuels technologies with extensive references to useful information sources. Chapter 1 presents a brief history and overview of biomass applications in the United States and offers relevant information resources. Also included are descriptions of federal programs that address biofuels. Although the primary focus of the guide is on US applications and research, Chapter 1 also reviews activities around the world. Chapter 2 surveys the biomass resources in the United States. Chapter 3 describes technologies for producing a number of liquid and gaseous fuels. Several environmental and economic aspects of biofuels are discussed in Chapter 4. Chapters 2 through 4 focus primarily on the technologies being pursued by the US Department of Energy (DOE) through the Biofuels and Municipal Waste Technology (BMWT) Division. Although this approach does not address all potential applications of biomass and wastes, it covers the majority of current US research on liquid and gaseous fuels. Chapter 5 is a directory of US agencies, companies, and laboratories involved in biofuels research. Each entry includes a description of the organization's activities, the address, and names of key contacts. Finally, Chapter 6 lists a variety of research tools, including bibliographies, data bases, directories, periodicals, and software.

35910 (SERI/SP–320-3396) **Fuels from microalgae.** Solar Energy Research Inst., Golden, CO (USA). Jun 1989. 36p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE88001192/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Many species of aquatic plants can provide a source of renewable energy. Some species of microalgae, in particular, produce lipids – oils that can be extracted and converted to a diesel fuel substitute or to gasoline. Since 1979 the Aquatic Species Program element of the Biofuels Program, has supported fundamental and applied research to develop the technology for using this renewable energy resource. This document, produced by the Solar Technical Information Program, provides an overview of the DOE/SERI

Aquatic Species Program element. Chapter 1 is an introduction to the program and to the microalgae. Chapter 2 is an overview of the general principles involved in making fuels from microalgae. It also outlines the technical challenges to producing economic, high-energy transportation fuels. Chapter 3 provides an overview of the Algal Production and Economic Model (APEM). This model was developed by researchers within the program to identify aspects of the process critical to performance with the greatest potential to reduce costs. The analysis using this model has helped direct research sponsored by the program. Finally, Chapter 4 provides an overview of the Aquatic Species Program and describes current research. 28 refs., 17 figs.

35911 (SERI/STR–211-3511) **Two-terminal $CuInSe_2$-based cascade cells: Annual subcontract report, 16 January 1987–15 January 1988.** Birkmire, R.W.; McCandless, B.E.; Phillips, J.E. Solar Energy Research Inst., Golden, CO (USA); Delaware Univ., Newark, DE (USA). Inst. of Energy Conversion. May 1989. 28p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89009422/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Results and conclusions from the first year of a two year research program on multijunction thin-film solar cells utilizing a $CuInSe_2$ heterojunction for the low band gap (E_g = 1.8 eV) or a CdTe (E_g = 1.5 eV) heterojunction for the high band gap component in a monolithic two-terminal cascade structure are reported. Physical vapor deposition with extrinsic doping was studied as a preparation technique for depositing low resistivity p-type CdTe on transparent ohmic contact materials at low temperature (T < 300°C). Photochemical vapor deposition was used to deposit a-Si cells. The presence of a $CuInSe_2$/(CdZn)S cell in the a-Si deposition reactor did not introduce contaminants or adversely affect the performance of conventional p-i-n cells. Procedures for fabricating monolithic cascade structures devices having the configuration ITO/a-Si(n-i-p)/ZnO/(CdZn)S/$CuInSe_2$/Mo/glass were developed. A prototype two-terminal cascade structure had an open circuit voltage over 1 volt. 8 refs., 6 figs., 7 tabs.

35912 (SERI/STR–211-3519) **Polycrystalline cadmium telluride n-i-p solar cell: Annual subcontract report, 1 June 1987–31 August 1988.** Meyers, P.V. Solar Energy Research Inst., Golden, CO (USA); Ametek Applied Materials Lab., Harleysville, PA (USA). Jun 1989. 58p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89009437/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The CdS/CdTe/ZnTe n-i-p solar cell and its ternary relatives have the potential to meet Department of Energy cost, efficiency, and stability goals. This report describes results of a continuing program to achieve these goals. A record-breaking efficiency of 11% has been demonstrated and verified at the Solar Energy Research Institute (SERI). Stability testing for 3000 hours indicates that the n-i-p structure is stable. Improving the short-circuit current by substituting $Cd_xZn_{1-x}S$ for CdS has been successful and has produced 8+% efficient cells with 2.6 eV windows using improved pyrolysis equipment. Transparent n-i-p devices have been produced with a SERI-verified efficiency of 9.4%. Collaborations with researchers at the Georgia Institute of Technology, the Institute of Energy Conversion, and Jet Propulsion Laboratory have resulted in jointly produced n-i-p cells. Cells produced by molecular beam epitaxy and metal organic chemical vapor deposition had efficiencies greater than 9%; cells produced by thermal vacuum evaporation had efficiencies greater than 7%. 18 refs., 35 figs., 13 tabs.

35913 (SERI/STR–211-3523) **Materials analysis and device optimization of $CuInSe_2$ solar cells: Annual subcontract report, 16 January 1987–15 January 1988.** Birkmire, R.W.; Phillips, J.E.; Shafarman, W.N. Solar Energy Research Inst., Golden, CO (USA); Delaware Univ., Newark, DE (USA). Inst. of Energy Conversion. Jun 1989. 62p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89009434/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report presents results and conclusions from the first year of research on $CuInSe_2$ thin-film solar cells. The research was carried out in two tasks: materials preparation and analysis and high-efficiency solar cell fabrication and analysis. $CuInSe_2$ thin films were prepared by vacuum evaporation of elemental Cu, In, and Se onto heated substrates. Systematic studies of the effects of incident flux and substrate temperature on $CuInSe_2$ film composition and morphology are presented. Mirror-smooth $CuInSe_2$ films were prepared using a newly developed aqueous bromine solution as chemical polishing etch. Heterojunctions photovoltaic devices with (CdZn)S, ITO/(CdZn)S, ZnO, and ZnO/(CdZn)S window layers were fabricated and analyzed. The dominant recombination mechanism in high-efficiency $CuInSe_2$ devices was found to be space-charge recombination in the $CuInSe_2$. Optimized one-square-centimeter $CuInSe_2$/(CdZn)S solar cells with efficiencies greater than 10% were fabricated. 17 refs.

35914 (SERI/STR–211-3528) **Research on stable, high-efficiency, large-area, amorphous-silicon-based submodules, Task B: Semiannual subcontract report, 16 March 1988–15 September 1988.** Delahoy, A.E.; Kampas, F.J. Solar Energy Research Inst., Golden, CO (USA); Chronar Corp., Princeton, NJ (USA). Jun 1989. 48p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89009439/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This research concerns the improvement of the efficiency and stability of large-area amorphous silicon photovoltaic submodules, based on both single- and tandem-junction device structures. For the improvement of cell efficiency, carbon-graded a-Si_xC_{1-x}:H p-layers, ITO/Ag back reflectors, alternate SnO_2 substrates, and TiO_x recombination layers at the n/p interface of tandem cells are described. Significant contributions to the study of transport and defect states in a-Si:H were made using the steady-state photocarrier grating technique, charge collection in thick p-i-n structures, thermally stimulated currents, and current DLTS. An extensive study of the deposition of SiO_2 barrier layers on soda lime glass to improve SnO_2:F conductivity is reported. Submodule research includes laser isolation, active scribe tracking, post-fabrication defect removal, and a new interconnect scheme employing two levels of metallization. Power output and aperture area efficiency for single junction submodules were 5.9W (7.0%) for 1 × 1 sq. ft. and 17.7W (6.9%) for 1 × 3 sq. ft. Outdoor stability tests on glass-glass encapsulated tandem submodules are also described.

35915 Applications of inclusion in separation science. Atwood, J.L. (Univ. of Alabama, AL (US)). v.v of Chemical separations. King, J.C.; Navratil, J.D. Litarvin Literature, Arvada, CO (1986). (CONF-860411–: 1. international conference on separations science and technology, New York, New York, USA, 15-17 Apr 1986).

Inclusion compounds have a long history of association with separation science. The host-guest concept has many desirable features, but the solids-handling problems have been difficult to overcome. In this review, the past work done on Werner coordination complexes, urea, and cyclodextrins is highlighted. New work on liquid clathrates is emphasized for the future.

35916 High temperature flood injury of woody swamp seedlings. Donovan, L.A. (Univ. of Utah, Salt Lake City, UT (US)); Stumpff, N.J.; McLeod, K.W. *Bulletin of the Ecological Society of America (USA)*, 68(3): 293 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

Seedlings in thermal effluent impacted swamp areas are exposed to varying combinations of elevated temperatures and flooding conditions. While species may be adapted to withstand flooded conditions, the addition of a high temperature stress may limit their ability to grow and survive. Bald cypress (Taxodium distichum (L.) Richard) and water tupelo (Nyssa aquatica L.) seedlings were exposed to simulated thermal effluents in a three month greenhouse study to examine various physiological responses. Flooding with ambient temperature (25 C) water had no effect on photosynthesis, transportation and root respiration rates, but decreased growth and tended to stimulate root ethylene production of both species. In addition to further growth reductions by the high temperature (40 C) flooded soil conditions, root respiration and ethylene production rates were decreased for both species and photosynthesis and transpiration were reduced for water tupelo seedlings. High temperature inhibition of ethylene production may be responsible for the observed reduction in morphological acclimation to flooding, hence limiting survival chances.

35917 Gas exchange characteristics of Pinus edulis and Juniperus monosperma. Barnes, F.J. (Los Alamos National Lab., Los Alamos, NM (US)). *Bulletin of the Ecological Society of America (USA),* 68(3): 259 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

A shift in the relative dominance of Pinus edulis and Juniperus monosperma is associated with a complex elevational gradient in northern new Mexico. The ecophysiological parameters contributing to this dominance pattern were studied by determining the gas exchange characteristics of the two species in response to temperature, light and water stress under controlled conditions. P. edulis has a higher photosynthetic capacity than J. monosperma, and has a tendency to form ecotypes with individuals from mesic sites having higher rates of carbon gain than xeric site individuals. J. monosperma is more drought-tolerant than P. edulis. As soil moisture decreases, zero carbon gain in J. monosperma occurs at a lower predawn leaf water potential (-4.6 MPa) than in P. edulis (-2.2 MPa). There is no significant difference between species in the temperature of peak carbon gain. J. monosperma has a significantly wider temperature optimum than P. edulis with the additional range being at high temperatures. The observed lower elevational limit of P. edulis coincides with its physiological tolerance of water stress as estimated by seasonal leaf carbon gain. Environmental limitations to the distribution of J. monosperma were not found at higher elevations where P. edulis is dominant.

35918 Canopy photography for assessment of local light environment of tropical forest trees and palms. Rich, P.M. (Los Alamos National Lab., Los Alamos, NM (US)); Clark, D.B.; Clark, D.A.; Oberbauer, S.F. *Bulletin of the Ecological Society of America (USA),* 68(3): 397 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

Crown light environments of juvenile trees were assessed using photographic techniques in primary tropical wet forest at La Selva Biological Station, Cost Rica. Hemispherical (fisheye) photographs were taken of the canopy above saplings of the emergent trees Lecythis ampla and Dipteryx panamensis and the subcanopy palms Welfia georgii and Iriartea gigantea. Negatives were video digitized and computer analyzed to estimate direct and diffuse components of light entering through openings in the canopy. Results from analyses of canopy photographs were calibrated using results of quantum sensor studies. Growth rates were directly related to inferred light availability. Changes in growth rates from year to year were associated with changes in canopy openings. Asymmetry of canopy openings resulted in substantial intracrown variability in quantum sensor measurements.

35919 Plant photosynthetic pathways and grazing by phytophagous orthopterans. Pinder, J.E. III (Savannah River Ecology Lab., Aiken, SC (US)); Jackson, P.R. *Bulletin of the Ecological Society of America (USA),* 68(3): 387-388 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

The hypothesis that phytophagous orthopterans avoid consuming C4 plants in preference for C3 plants was tested by comparing the carbon isotope ratios of orthopterans to that expected for proportional consumption of plants in two old-field communities. The species composition of the plant community allowed valid tests of avoidance for only 10 of the 18 abundant orthopteran species. Six species demonstrated C4 avoidance, whereas three species fed on C4 plants and avoided C3 plants. One species consumed C3 and C4 plants in proportion to their abundance in the plant community. Problems involved in testing the C4 avoidance hypothesis under field conditions are discussed.

35920 Cedar barrens. Parr, P.D. (Oak Ridge National Lab., Oak Ridge, TN (US)); Pounds, L.R. *Bulletin of the Ecological Society of America (USA),* 68(3): 384 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

Oak Ridge National Environmental Research Park staff are working with the Tennessee Department of Conservation and Boeing Tennessee, Inc. to preserve and monitor an area containing one of the best known remaining examples of the rare cedar barrens plant community. Several rare plant species occur on the site and research has been initiated on Agalinis auriculata which is under consideration for federal listing. Preliminary data collected in 1984 has demonstrated an increase in Agalinis with movement out of the sampling grid area. Of 132 plants sampled in 1986, the Agalinis was found most often in a moss substrate (43%), on bare ground (28%) and in grass litter (23%). preliminary germination studies indicate it is an early spring germinating summer annual. Research has been initiated to determine seed bank information, germination requirements, seedling survival, and insect predation.

35921 Measurement of SO_2 uptake and redistribution of sulfur in a pine canopy using ^{35}S. Murphy, C.E. Jr. (E.I. du Pont de Nemours and Co., Savannah River Lab., Aiken, SC (US)); Gay, D.W. *Bulletin of the Ecological Society of America (USA),* 68(3): 374 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

Branches of loblolly pine were exposed to sulfur-35 dioxide in the field with a portable chamber. The exposed branches were excised and a sample of needles was immediately washed with distilled water. The needles and water collected in the field were analyzed for sulfur-35 content. The results indicated that a portion of the sulfur-35 could be washed from the needles and another portion was not removed with the water rinse. The portion that could not be removed by water rinsing was absorbed in a manner that suggested absorption by stomatal diffusion, and thus was internal. The sulfur-35 that could be removed by rinsing appeared to be surface absorption. An analysis of the distribution of sulfur-35 by serial extractions indicated that shortly after internal absorption, the sulfur-35 was equally distributed between material extracted with acetone, with hexane, and the fraction not removed by these two extractions.

35922 Free life history strategies. Loehle, C. (Savannah River Ecology Lab., Aiken, SC (US)). *Bulletin of the Ecological Society of America (USA),* 68(3): 353 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

Current life history theory is dominated by the r-K continuum, originally developed for animals. Because plants are sessile and plastic in their growth, the r-K model is inadequate. A new model is developed for plants in which the major tradeoff is between fast growth and defense of tissues. Plants at either end of the spectrum may have large numbers of seeds, or not. Interactions between defensive investments and shade tolerance, growth rate, longevity, and age of maturity are explored with data on 158 species of North American trees.

35923 GIS and remote sensing as tools for detection of landscape pattern and processes. Iverson, L.R. (Illinois Natural History Survey, Champaign, IL (US)); Cook, E.; Graham, R.L. *Bulletin of the Ecological Society of America (USA),* 68(3): 330 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

The Illinois Geographic Information System is equipped for GIS and image analysis which allows pursuit of many specific landscape-level questions. By overlaying historic vegetation maps with current maps, one can assess the factors contributing to long-term land-use change. GIS processing also provides for rapid determination of the suitability or susceptibility of phenomena occurring on landscapes. Examples of this type of processing include susceptibility to erosional soil loss or to crop yield reduction from droughts, and the suitability of various landscapes to provide adequate habitat for endangered plant species. The coupling of GIS processing with image analysis of satellite data provides a means for detecting changes and processes within landscapes. Some significant relationships have been uncovered, for example, among Landsat TM spectral data, site landscape variable, and ground-obtained forest productivity estimates.

35924 Net throughfall chemistry and atmospheric deposition at two forests of different elevations. Schaefer, D.A. (Oak Ridge National Lab., Oak Ridge, TN (US)); Lindberg, S.E. *Bulletin of the Ecological Society of America (USA),* 68(3): 408 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

We are measuring atmospheric deposition and throughfall chemistry at two coniferous sites. The higher (1800m) site is a red spruce (Picea rubens) forest; the lower (300m) is a loblolly pine (Pinus taeda) forest. Summed net chemical fluxes in throughfall (calculated as throughfall depth X concentrations minus rain depth X concentrations) are compared for April through July. Net fluxes of SO_4^{2-}, NO_3^-, Na^+, and Cl^-, in throughfall are greater at the spruce site. Net fluxes of K^+ and NH_4^+ in throughfall are greater at the pine site. Net fluxes of Ca_2^+ and Mg_2^{+4} are nearly equal. Air concentrations and surrogate surface fluxes are quite similar between sites, except for higher NO_3^- particle flux at the spruce site. Greater net throughfall fluxes at the spruce site reflect both greater canopy surface area, and cloud deposition to this site. Greater net K^+ flux at the pine site reflects canopy losses. Negative NH_4^+ flux indicates spruce canopy uptake.

1406 Photovoltaic Power Systems

Refer also to citation(s) 36342, 36343

1407 Solar Thermal Power Systems

Refer also to citation(s) 35930, 36591

35925 (DOE/CH/10093–46) **Solar thermal program summary: Volume 2, Research summaries: Fiscal year 1988.** Solar Energy Research Inst., Golden, CO (USA). May 1989. 90p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89000861/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The Solar Thermal Program Summary for Fiscal Year 1988 is a two- volume reference set describing the technological advances and future research and development (R&D) direction of the Solar Thermal Technology Program. Volume I contains capsule descriptions of the various activities undertaken in the year, a brief history of the program, and the significant accomplishments realized. It also describes the management framework for the program and sets forth the FY 1988 budget. Volume II consists mainly of a compilation of detailed descriptions of the various R&D activities performed by the national laboratories and their subcontractors from industry, academia, and nonprofit research institutions. It also contains a bibliography of the various publications produced under the program in recent years.

35926 (SAND–89-7027) **An improved design for stretched-membrane heliostats.** Beninga, K.; Butler, B.; Sandubrae, J.; Walcott, K. Sandia National Labs., Albuquerque, NM (USA); Science Applications International Corp., San Diego, CA (USA). Energy Projects Div. Jun 1989. 184p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE89013872/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

Science Applications International Corporation (SAIC) has developed an improved stretched-membrane heliostat mirror module under contract to Sandia National Laboratories, Albuquerque, New Mexico. Both a 150-m^2 commercial mirror module and a 50-m^2 prototype mirror module have been designed. The prototype mirror module has been fabricated and is being tested at the Central Receiver Test Facility (CRTF) in Albuquerque. Two .0762-mm (.003-in) thick stainless steel membranes are stressed to approximately 90 MPa (13,000 psi) and welded to either side of a carbon steel, rectangular cross-section ring, which is compressed to approximately one-tenth of its yield strength. The ring is supported by five trusses, which radiate from a central hub. The mirror module is mounted on a conventional pedestal drive system for sun-tracking purposes. The mirror module is air-tight, and focusing is achieved by modulating the position of the back membrane. The ring stiffness and tolerance achievable by conventional manufacturing methods dictate the ring distortions prior to installation of the mirror module. Once the mirror module is installed, wind loads on the heliostat exert additional out-of-plane loads. A comprehensive finite-element computer model of the mirror module was used for the structural design of the ring/membrane system and truss supports. The analysis and design methods used are reported, and an improved mirror module design is described. Preliminary test results indicate the prototype mirror module meets all design performance goals. The unit has a full cone angle reflected beam dispersion of 2.8 mrad and can defocus in five seconds. 25 refs., 77 figs., 17 tabs.

1409 Solar Thermal Utilization

Refer also to citation(s) 35937, 36383

35927 (DOE/SF/16306–15) **Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of May and June 1989.** Colorado State Univ., Fort Collins, CO (USA). Solar Energy Applications Lab. Jul 1989. 18p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG03-86SF16306. Order Number DE89014525/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Cooling performance analysis of the data collected over the past four years in the research and development of the SENC solid desiccant cooling system is nearing completion. Computer models are being developed of two system designs: (1) the present system configuration with constant collector flow rate and one mixed storage tank, and (2) the proposed system with variable collector flow to maintain constant collector outlet temperature and two storage tanks (complete thermal stratification). These models are expected to reveal the annual heating system performance difference which will be realized by changing to constant collector temperature operation in Solar House I. Also the model will provide optimization with respect to storage tank temperature settings, load side heating capacity, etc.

1410 Solar Collectors and Concentrators

Refer also to citation(s) 35926, 36591

35928 (AD-A–205076/3/XAB) **Transparent glass ceramics doped by chromium(III) and chromium(III) and neodymium(III) as new materials for lasers and luminescent solar concentrators. Final report, 1 October 1985-30 June 1988.** Reisfeld, R. Hebrew Univ., Jerusalem (Israel). Dept. of Inorganic and Analytical Chemistry. 27 Dec 1988. 41p. Available from NTIS, PC A03/MF A01.

Transparent glass ceramics doped by chromium (III) and codoped by chromium (III) and neodymium (III) having the structure of spinel, gahnite, petalite and mullite were prepared. Steady-state spectroscopy (absorption and emission) as well as time-resolved spectroscopy were studied at room temperature and varying temperatures down to that of liquid helium. Quantum efficiency of chromium (III) at room temperature is high, between 0.9 and 1.0, in mullite glass ceramics. Cross sections for laser and laser threshold were calculated. The potential application of these materials for tunable lasers in the red and near infrared is described.

35929 (DOE/CE/15289–T1) **Development of a carbonaceous selective absorber for solar thermal energy collection and process for its formation: Final report.** Garrison, J.D. San Diego State Univ., CA (USA). Dept. of Physics. 25 Feb 1989. 23p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG01-86CE15289. Order Number DE89008587/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The main goal of the US Department of Energy supported part of this project is to develop information about controlling the complicated chemical processes involved in the formation of a carbonaceous selective absorber and learn what equipment will allow production of this absorber commercially. The work necessary to accomplish this goal is not yet complete. Formation of the carbonaceous selective absorber in the conveyor oven tried so far has been unsatisfactory, because the proper conditions for applying the carbonaceous coating in each conveyor oven fabricated, either have been difficult to obtain, or have been difficult to maintain over an extended period of time. A new conveyor oven is nearing completion which is expected to allow formation of the carbonaceous selective absorber on absorber tubes in a continuous operation over many days without the necessity of cleaning the conveyor oven or changing the thickness of the electroplated nickel catalyst to compensate for changes in the coating environment in the oven. Work under this project concerned with forming and sealing glass panels to test

ideas on evacuated glass solar collector designs and production have been generally quite satisfactory. Delays in completion of the selective absorber work, has caused postponement of the fabrication of a small prototype evacuated glass solar collector panel. Preliminary cost estimates of the selective absorber and solar collector panel indicate that this collector system should be lower in cost than evacuated solar collectors now on the market. 4 figs.

35930 (SERI/SP–220-3237) **Progress in parabolic dish technology.** Stine, W.B. Solar Energy Research Inst., Golden, CO (USA). Jun 1989. 52p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89009427/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report describes the current status of parabolic dish technology. Its purpose is to communicate the principal outcomes of DOE's parabolic dish technology R&D efforts carried out at the Solar Energy Research Institute; Sandia National Laboratory, Albuquerque; the Jet Propulsion Laboratory; and other DOE national laboratories. It is written for those in industry, academia, and government who have a special interest in solar thermal systems that use parabolic dishes as collectors. The evolution of parabolic technology is described, and examples of projects in operation and under construction are included. Solar thermal dish technology can supply either electric or thermal energy to various applications over a broad range of system sizes and temperatures. These solar energy systems will be available by the time this country needs additional electric generation capacity – in the mid to late 1990s – at costs competitive with other energy sources. 9 refs., 54 figs., 6 tabs.

1420 Heat Storage

Refer also to citation(s) 36218, 36382

35931 (ITL–8509, pp. 290-294) **Heat pump with a hard rock well equipped for thermal recharging.** Tollin, J. (AIB Consulting Engineers, Solna, Sweden). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A rock heat installation for a detached house has been equipped with a simple, cylindrical air and solar heat exchanger to charge the rock store, primarily during the six summer months. Preliminary results from 9 months of measurements indicate that the air heat exchanger decreases the load of the rock heat collector by approximately 6000 kWh annually, of which 3000 kWh is actively charged into the rock during the summer months. The rock heat output without an air heat exchanger is otherwise 18,000 kWh annually. The air heat exchanger yields approximately 4^0C higher brine solution temperatures during autumn and spring, and approximately 5-9^0C higher temperatures in the summer. In the winter, there is no marked rise in brine solution temperature, and the performance of the rock heat collector will be decisive for the operation of the heat pump. The heat pump's performance has risen 10-15%, i.e. the annual operating time has been reduced from approximately 3500 h/y without the air heat exchanger to below 3200 h/y. 6 refs., 2 figs., 3 tabs.

35932 (ITL–8509, pp. 353-363) **Technical and economic feasibility of central solar heating plants with seasonal storage.** Bankston, C.A. (Charles A. Bankston, Inc., Washington, DC, USA). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A unified analysis and parametric study of Central Solar Heating Plants with Seasonal Storage(CSHPSS) systems has recently been compiled. The study culminated nearly three years of information collection, evaluation, preliminary design and analysis, and system simulation. It included systems with stationary and tracking collector arrays; water tank, rock cavern, water pit, drilled earth and rock fields, and natural aquifers storage subsystems; heat pump and direct coupled loads, and loads representing 50 to 5000 residential units with domestic hot water fractions ranging from 20 to 50%. Each configuration was independently optimized using the Swedish IEA-developed computer code MINSUN. Results of the unified study indicate that a number of CSHPSS configurations are economically competitive with conventional plants now and are clearly economically superior to diurnal solar systems. Additional studies are now in progress that will verify these findings in the context of specific national economies and climates. 1 refs., 6 figs., 1 tab.

35933 (ITL–8509, pp. 455-460) **The Vaulruz project experimental results.** Hadorn, J.C. (SORANE S.A., Lausanne, Switzerland); Chuard, P.; Chuard, D. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This paper presents some experimental results concerning a solar heating plant with seasonal heat storage and heat pump in Vaulruz, Switzerland. It is basically a solar heating plant (550 m^2 of double glazed flat plate roof integrated solar collectors), a seasonal storage of heat (3500 m^3 of earth, with plastic tubes and insulation), an electrically driven 44 kW heat pump, and an auxiliary oil burner. The total annual load in 1984 was 450 MWh covered up to 72% by the heat pump, 19% by the oil burner, and 9% directly by the solar collectors or the storage. The monitoring approach is described and the results from March 1983 to December 1984 are presented. The system components behave as expected (high annual collector efficiency, storage temperature as foreseen), except the heat pump, which is expected to be improved by the manufacturer. 2 refs., 7 figs.

35934 (ITL–8509, pp. 443-447) **Analysis and theoretical design of central solar heating plant with seasonal storage in Poland.** Dytczak, M. (Technical Univ. of Warsaw, Warsaw, Poland); Turlejski, S. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Calculations and theoretical system design of a central solar heating plant with seasonal storage (CHSPSS) in Poland have been carried out. The mathematical models describing heat transfer between the different elements (store, district heating system, collector piping system, and heating installations in houses) and the surroundings, take into consideration the dynamics of these elements using the theory of linear systems. For each of these elements, response functions are theoretically estimated based on climatic parameters for a test reference year, temperature of the working fluids, etc. The discrete functions describing heat transfer between the elements and the surroundings as a function of time are determined using the convolution theorem. This method results in very fast and detailed simulation of CSHPSS performance over a long period of time. The design problem (exemplified by an estate consisting of

200 single-family houses) is treated as a multi-level optimization task. 5 refs., 5 figs.

35935 (ITL–8509, pp. 421-425) **The Lyckebo rock cavern seasonal storage plant experience of one year of operation.** Brunstroem, C. (Swedish State Power Board, Aelvkarleby, Sweden); Larsson, M.; Holst, P.; Zinko, H.; Hillstroem, C.-G. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The main objective of the Lyckebo project is to develop and demonstrate a large-scale solar district heating system with seasonal storage in a rock cavern. Performance data from one year of operation with the plant were measured. An annual collector field heat production of 287 kWh/m^2 at a mean operating temperature of 62^{0}C was obtained. The corresponding global collector plane irradiation was 989 kWh/m^2 resulting in a collector field efficiency of 29%. The storage heat loss during the year amounted to 3.14 GWh, corresponding to 26% of the heat production. The annual energy-weighted loading and unloading mean temperatures, measured in the interconnecting culvert, were 84 and 62^{0}C respectively, giving storage mean temperature maximum and minimum values of 68 and 45^{0}C respectively during one storage cycle. The energy efficiency obtained for a complete storage cycle was 0.74. The performance results showed that effective production and storage of solar energy is possible with highly efficient flat plate collectors and rock cavern seasonal storage, although not yet economically competitive. 7 refs., 6 figs., 3 tabs.

35936 (ITL–8509, pp. 437-442) **A solar heating plant with heat pump and seasonal storage. System design influence on thermal performance and economy.** Dalenbaeck, J.-O. (Chalmers Univ. of Technology, Gothenburg, Sweden). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The solar heating plant in Lambohov was built primarily as an experimental installation for large-scale solar heating applictions in Sweden. It consists of 2800 m^2 of flat plate roof-integrated solar collectors, and an insulated 10,000 m^3 water pit in rock combined with heat pumps for seasonal storage. The design objective was to meet 100% of the annual heating requirements of 55 terraced houses with a solar energy coverage of 85%. Comprehensive measurements of system performance were made during 1983. One of the results of this work was to show that the solar energy coverage amounted to about 70%. The heat losses from the storage were higher than expected during the design stage due to penetration of ground water into the insulation. This paper presents general conclusions concerning solar heating technology and economy. System design calculations have been made and one of the main results is to show that the solar energy coverage could be the same for a system design without heat pumps. The economic results consider both the actual solar enegy heating costs achieved and the estimated costs for a similar plant built today without heat pumps, and shows promising low energy costs. 4 refs., 2 figs., 2 tabs.

35937 (ITL–8509, pp. 432-436) **Model of a heating installation consisting of solar collectors, storage tank and heat pump.** Charlier, M. (Unite Thermodynamique, Univ. Catholique de Louvain, Louvain-la-Neuve, Belgique); Wauters, P. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

An experimental residential heating facility has been designed consisting of solar collectors, low-temperature heat storage provided by a tank containing 7 m^3 of glycol solution, and a glycol solution-to-air heat pump. Programs in 1983 and 1984 were conducted to systematically measure the following parameters: temperature, flow, pressure and electrical consumption. A theoretical study of the behaviour of each component considered separately (solar panels, storage tank and heat pump) was done for the purpose of developing a theoretical operational model of this system and preparing related simulation software. This model showed the predominant influence of the heat storage in the installation. A more thorough study of this storage was then conducted. This involved examination of the phenomenon of mixing of the various glycol solution layers in the tank and consideration of other more suitable storage methods (water-ice mixture). The paper establishes energy and economic balances for situations in which the following parameters vary: storage capacity, conduction coefficient of the walls, coefficient of stratification and percentage of ice in the glycol solution tank. 7 refs., 4 figs., 3 tabs.

15 GEOTHERMAL ENERGY

Refer also to citation(s) 36370

1501 Resource Status and Assessment

Refer also to citation(s) 35938

1502 Geology and Hydrology of Geothermal Systems

Refer also to citation(s) 35938

1503 Geothermal Exploration and Exploration Technology

Refer also to citation(s) 37412

35938 (DOE/ID/12549–1) **The hydrothermal system in central Twin Falls County, Idaho.** Lewis, R.E.; Young, H.W. Geological Survey, Boise, ID (USA). Water Resources Div.; Idaho Dept. of Water Resources, Boise, ID (USA). 1989. 44p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG07-84ID12549. (USGS-WRI–88-4152). Order Number DE89014219/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report describes the results of a study to define the areal extent and thickness of the hydrothermal reservoir in Twin Falls County and to propose a generalized conceptual model of the system. Specific objectives of the study, done in cooperation with the Idaho Department of Water Resources, were to evaluate the existing resource as to its volume, temperature, pressure, and water chemistry, and to determine the effects of present development on the resource. The study was limited to Twin Falls County. Some geologic, geochemical, and hydrologic data for the hydrothermal system were available from earlier studies. However, information about the subsurface at depths greater than 1000 feet was sparse. One well for which data were available was drilled to 2525 feet; several others were drilled to depths between 1200 and 2200 feet. Direct-current electrical resistivity soundings conducted during the summer of 1985 as part of the study provided valuable information about the subsurface at depths less than about 6000 feet. Interpretation of computer-generated subsurface profiles constructed from the soundings provided the basis for determining the thickness of the Idavada Volcanics over much of the study area. 42 refs., 9 figs., 3 tabs.

35939 (UCRL–21132) **Modeling of subsurface geology in Medicine Lake, California.** Rial, J.A.; Saltzman, N. Lawrence Livermore National Lab., CA (USA). 26 Jul 1988. 8p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-7405-ENG-48. Order Number DE89014266/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this document we present the results of our analysis of data from 16 three-component seismometers and 8 dynamite explosions around the Medicine Lake volcano's Glass Mountain in northern California. The Medicine Lake volcano is located just northeast of the southeastward-trending Cascade Range of shield and small composite volcanoes. 2 refs., 6 figs.

1505 Economic and Financial Aspects

Refer also to citation(s) 35940

1508 Geothermal Power Plants

35940 (LA-UR–89-1811) **An economic prefeasibility study of geothermal energy development at Platonares, Honduras.** Trocki, L.K. Los Alamos National Lab., NM (USA). 1989. 13p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8903134–2: Circum-Pacific energy and minerals conference, San Jose, Costa Rica, 5-8 Mar 1989). Order Number DE89012634/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

The expected economic benefits from development of a geothermal power plant at Plantanares in the Department of Copan, Honduras are evaluated in this report. The economic benefits of geothermal plants ranging in size from a 10-MW plant in the shallow reservoir to a 20-, 30-, 55-, or 110-MW plant in the assumed deeper reservoir were measured by computing optimal expansion plans for each size of geothermal computing optimal expansion plans for each size of geothermal plant. Savings are computed as the difference in present value cost between a plan that contains no geothermal plant and one that does. Present value savings in millions of 1987 dollars range from $25 million for the 10-MW plant to $110 million for the 110-MW plant – savings of 6% to 25% over the time period 1988 through 2008. The existence of the shallow reservoir is relatively well-characterized, and much indirect scientific evidence indicate the existence of the deeper reservoir. Based on probability distributions estimated by geologists of temperature, areal extent, depth, and porosity, the expected size of power plant that the deep reservoir can support was estimated with the following results: O-MW – 16% (i.e., there is a 16% chance that the deep reservoir will not support a power plant); 20-MW – 38%; 30-MW – 25%; 55-MW – 19%; and 110-MW – 2%. When the cost savings from each size of plant are weighted by the probability that the reservoir will support a plant of that size, the expected monetary value of the deep reservoir can be computed. It is $42 million in present value 1987 dollars – a cost savings of 10%. The expected savings from the 10-MW plant in the shallow reservoir are expected to be close to the computed value of $25 million, i.e., the probability that the shallow reservoir can support the plant is high. 4 refs., 3 figs., 2 tabs.

1509 Geothermal Engineering

Refer also to citation(s) 35634

35941 (LA-UR–89-1878) **A discrete fracture model for a hot dry rock geothermal reservoir.** Robinson, B.A. Los Alamos National Lab., NM (USA). 1989. 14p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-7405-ENG-36. (CONF-8906142–1: International hot dry rock (HDR) geothermal energy conference, Camborne, UK, 27-30 Jun 1989). Order Number DE89013462/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Modeling results are presented for the Fenton Hill Phase II reservoir using a two-dimensional steady state simulator of fluid flow and solute transport in fractured porous media. Fluid flow and tracer response data are simulated using a fracture flow model in which the fracture apertures are string functions of pressure. The model is used to match the available steady state data of pressure drop versus flow rate and the tracer data. Various schemes for improving reservoir performance, such as high backpressure, chemical etching, stimulation using a viscous fluid, and the drilling of a second production wellbore, are then examined. 15 refs., 7 figs., 4 tabs.

35942 (LA-UR–89-2129) **Reservoir water loss modeling and measurements at Fenton Hill, New Mexico.** Brown, D.W. Los Alamos National Lab., NM (USA). 1989. 12p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-7405-ENG-36. (CONF-8906142–2: International hot dry rock (HDR) geothermal energy conference, Camborne, UK, 27-30 Jun 1989). Order Number DE89014222/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An extensive series of pressurized reservoir water loss experiments are presently being conducted in the deeper Phase II reservoir, at the Laboratory's Fenton Hill site in north-central New Mexico. The objectives of these experiments are: to measure the reservoir water leak-off rate at a number of equilibrium reservoir pressure levels, and as a function of time; and with this pressure- and time-dependent water-loss data, to determine the joint dilation (i.e., mean joint porosity) of the reservoir as a function of pressure up to about 24 MPa (as measured at the surface). The permeability model of Gangi has been used to explain the Phase II reservoir water loss as measured during two reservoir flow tests of 7 and 30 days duration. During the 30-day flow test, the model strongly suggests that the reservoir was actively growing by fracture extension, even at injection pressures as low as 27 MPa, which is confirmed by our seismic observations. 3 refs., 6 figs., 1 tab.

35943 (SAND–89-0079) **PDC [polycrystalline diamond compact] bit research at Sandia National Laboratories.** Finger, J.T.; Glowka, D.A. Sandia National Labs., Albuquerque, NM (USA). Jun 1989. 76p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE89013885/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

From the beginning of the geothermal development program, Sandia has performed and supported research into polycrystalline diamond compact (PDC) bits. These bits are attractive because they are intrinsically efficient in their cutting action (shearing, rather than crushing) and they have no moving parts (eliminating the problems of high-temperature lubricants, bearings, and seals.) This report is a summary description of the analytical and experimental work done by Sandia and our contractors. It describes analysis and laboratory tests of individual cutters and complete bits, as well as full-scale field tests of prototype and commercial bits. The report includes a bibliography of documents giving more detailed information on these topics. 26 refs.

1520 Geothermal Data and Theory

Refer also to citation(s) 36203

16 TIDAL AND WAVE POWER

1605 Environmental Aspects

35944 (ETSU-TID–4055-P2) **Wader migration and distribution in South West estuaries. V. 2. Appendices.** UKAEA Harwell Lab. (UK). Energy Technology Div.; British Inst. for Ornithology, Tring (UK). 1989. vp. Available from British Library, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Two sets of data tables relating to a study of the potential effect on wading birds and wildfowl of a tidal barrage on the River Severn are presented. The first set records recoveries of ringed birds of six species which indicate the origins of waders and wildfowl using the Severn estuary. The second set records the distribution of fifteen species feeding on the mudflats of the Severn estuary. (U.K.).

35945 (ETSU-TID–4059) **Prediction of post barrage densities of shorebirds. V. 4. Birds.** Goss-Custard, J.D.; McGrorty, S.; Pearson, B.; Clarke, R.T.; Rispin, W.E.; Durell, S.E.A.leV. dit; Rose, R.J. UKAEA Harwell Lab. (UK). Energy Technology Div.; Natural Environment Research Council, Plymouth (UK). Plymouth Marine

Lab. 1989. 134p. Available from British Library, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This study was designed to test whether or not the densities of shore-birds post-barrage on the River Severn could be predicted from (a) the predicted densities of the main prey species and (b) the predicted values of shore-width, shear-strength of the sediments and exposure time (physical variables). The methodology was to regress bird densities against these variables across 40 sites situated in six estuaries, including the Severn. It was concluded that bird density was directly dependent on prey density. The physical variables had an additional effect in the case of only three of the eight bird species studied; time available for feeding had no effect on density. The relatively low invertebrate densities on the Severn estuary might be improved by a different pattern of sedimentation post-barrage leading to greater bird densities. It is not possible at present, however, to predict the post-barrage conditions sufficiently well.

35946 (ETSU-TID–4061) **Prediction of post barrage densities of shorebirds. V. 3. Invertebrates.** UKAEA Harwell Lab. (UK). Energy Technology Div.; Natural Environment Research Council, Plymouth (UK). Plymouth Marine Lab. 1989. 112p. Available from British Library, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

A comparative survey of the intertidal benthic invertebrate communities at 40 sites in estuaries in S.W. Britain has been undertaken. These estuaries include the Severn and five others which span the range of environmental conditions expected to occur in a post-tidal barrage Severn. Multivariate analysis of the invertebrate species abundance and biomass data showed that the fauna of the Severn estuary sites was significantly distinct from all the other estuaries, the latter forming a single cluster with few differences between them. In comparison with other estuaries, populations of several invertebrate species were dominated by small individuals in the Severn, suggesting a shorter lifespan. Of the bird species studied, only dunlin were indifferent to the invertebrate community composition, having similar densities per unit area in the Severn and other estuaries. Seven other species showed a preference for the invertebrate association characterising the other estuaries, and attained higher densities there. Qualitative predictions for the post barrage Severn include changes in invertebrate species composition and size distribution, and improved feeding conditions for all bird species studied, except dunlin.

35947 (ETSU-TID–4062-P1) **Prediction of post barrage densities of shorebirds. V. 1. Overview.** UKAEA Harwell Lab. (UK). Energy Technology Div. 1989. 22p. Available from British Library, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The objective of this study was to develop models for predicting the densities of shorebirds after a tidal barrage is built. These models showed that, with the exception of Dunlin, the doubling of invertebrate prey density required in the existing feeding areas, to maintain the present numbers of birds in the Severn estuary, fall within the range of prey densities that already occur in other estuaries, so in principle could be achieved. An increase in the productivity of areas that are little used at present, or creation of new areas, could further increase the capacity of the estuary as a whole to support the necessary bird numbers. Whether this will happen, however, depends on quantitative predictions of post-barrage invertebrate densities, which are not yet possible. Further studies are suggested to improve quantitative predictions of post-barrage densities of invertebrates and birds, particularly for Dunlin as the Severn is of such special significance to them.

35948 (ETSU-WN–4055-P1) **Wader migration and distribution in South West estuaries (in relation to the Severn Barrage). V. 1.** UKAEA Harwell Lab. (UK). Energy Technology Div.; British Inst. for Ornithology, Tring (UK). 1989. 277p. Available from British Library, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

A study has been undertaken with three main objectives: 1. to identify the origins and movement patterns of waders and wildfowl using the River Severn. 2. to evaluate the patterns of low tide usage of the estuary by waders and Shelduck and to identify preferred areas. 3. to evaluate the capacity of adjacent estuaries to absorb any waders displaced from the Severn by a barrage. These objectives were achieved by both computer analysis of existing British Trust for Ornithology data and the collection of new field data. Overall four key species (Shelduck, Dunlin, Curlew and Redshank) occurring in internationally important numbers on the Severn are identified as most likely to be adversely affected by a barrage. It is unlikely that displaced birds of these species could be absorbed by other estuaries in southwest Britain.

1607 Tidal Power Plants

35949 (ETSU-TID–4048-P2) **River Loughor tidal power scheme. A feasibility study report.** Energy Technology Support Unit, Harwell (UK). 1989. vp. Available from British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The potential for constructing a tidal power barrage on the river Loughor in South Wales has been explored. An optimum barrage would comprise four turbines and four sluices with an installed capacity of 5MW. While this would be technically feasible an examination of the costs involved have shown that it would not be economic. Lower unit costs for electricity generation might be achieved by constructing a multipurpose barrage with amenity benefits, but the implications of the water levels required and the effects on water quality need clarification. (U.K.).

35950 (ETSU-TID–4066-P1A) **Generic steel designs for tidal power barrages. V. 1, pt. 1.** UKAEA Harwell Lab. (UK). Energy Technology Div.; Steel Construction Inst., Ascot (UK). 1989. vp. Available from British Library, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This report presents the results of a generic study into the use of steel for tidal power barrages. Volume I is in two parts, Part 1 contains the bench mark designs and costs for large, medium and small schemes and Part 2, the generic design data. The work demonstrates that steel structures can be designed for use in a marine environment with satisfactory design life for strength and durability. As well as being able to compete with other forms of construction for the look-alike designs, it is shown that when the attributes of steel, such as its high strength to weight ratio, are applied to the designs, more economical configurations are possible. The nature of a steel construction, having good floating characteristics thereby reducing installation constraints, permits very efficient designs which may not be possible with some lower strength to weight structural materials.

35951 (ETSU-TID–4066-P1B) **Generic steel designs for tidal power barrages. V. 1, pt. 2.** UKAEA Harwell Lab. (UK). Energy Technology Div.; Steel Construction Inst., Ascot (UK). 1989. vp. Available from British Library, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This report presents the results of a generic study into the use of steel for tidal power barrages. Volume I is in two parts, Part 1 contains the bench mark designs and costs for large, medium and small schemes and Part 2, the generic design data. The work demonstrates that steel structures can be designed for use in a marine environment with satisfactory design life for strength and durability. As well as being able to compete with other forms of construction for the look-alike designs, it is shown that when the attributes of steel, such as its high strength to weight ratio, are applied to the designs, more economical configurations are possible. The nature of a steel construction, having good floating characteristics thereby reducing installation constraints, permits very efficient designs which may not be possible with some lower strength to weight structural materials.

17 WIND ENERGY

1706 Wind Energy Engineering

35952 (SERI/TP–217-3505) **Three-dimensional airfoil performance measurements on a rotating wing.** Butterfield, C.P. Solar Energy Research Inst., Golden, CO (USA). Jun 1989. 5p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-890717–2: European wind energy conference and exhibition, Glasgow, UK, 10-13 Jul 1989). Order Number DE89009443/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of this comprehensive research program was to study the effects of horizontal-axis wind turbine (HAWT) blade rotation on aerodynamic behavior below, near, and beyond stall. This paper describes the flow angle sensor used to measure angle of attack (AOA) and how the sensor was calibrated, and it gives results of pressure integrations on the blade. Aerodynamic, load, flow-visualization, and inflow measurements were made on a 10-m, three-bladed, downwind HAWT. A video camera was mounted on the rotor to record video images of tufts attached to the low-pressure side of a constant-chord, zero-twist blade. Load measurements were made using strain gages mounted every 10% of the blade's span. Pressure taps were located at 32 chordwise positions and revealed pressure distributions comparable with wind tunnel data. Inflow was measured using a vertical-plane array of eight propvane and five triaxial (U-V-W) prop-type anemometers located 10 m upwind in the predominant wind direction. Results show evidence of stall hysteresis and unsteadiness at high AOA. Correlations with analytical predictions and wind tunnel tests show good agreement at low AOA and poor agreement at high AOA. 7 refs., 12 figs.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants and Power Generation

Refer also to citation(s) 35524, 35537, 35542, 35564, 35565, 35581, 35589, 36423, 36577, 36895

35953 (EMR–M91-7/30-1988E) **Waste heat recovery in remote communities. A shared opportunity.** Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1988. 133p. (MICROLOG–89-02005). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This elementary report is intended to assist residents of remote communities, utilities, and governments in developing the potential of the rejected heat from diesel-electric generating plants. It describes briefly the components of a waste heat recovery/distribution (WHR/D) system, as well as the benefits of utilizing recovered heat. It describes the WHR/D system installed at the Attawapiskat (Ontraio) Hospital, discusses the planning, construction, and operational phases of a WHR/D project, project management (work sharing, etc.), the financial evaluation of a project, and the economic and social impacts on the community. The report addresses a typical project from a technical standpoint, describing the value of feasibility studies, and the planning and processes involved in project management, such as engineering design, procurement, construction, and commissioning. Finally, it deals with agreements and contracts. 3 refs., 20 figs., 1 tab.

35954 (EPRI-EL–4651-Vol.3) **Electromagnetic transients program (EMTP): Volume 3, Workbook III: Final report.** Alvarado, F.L. Electric Power Research Inst., Palo Alto, CA (USA); Wisconsin Univ., Madison, WI (USA). Dept. of Electrical and Computer Engineering. c Jun 1989. 147p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This workbook is the third in a series of books intended to introduce the EMTP to users. It assumes that the user is familiar with elementary uses of the EMTP and presents more advanced modeling techniques. The workbook uses a case-study approach, where gradually more sophisticated models of the same system are introduced. This book covers mainly transformers, synchronous machines and induction motors. It includes a description of SSR (SubSynchronous Resonance).

35955 (EPRI-GS–6415) **A comparison of steam-injected gas turbine and combined-cycle power plants: Technology assessment: Final report.** Electric Power Research Inst., Palo Alto, CA (USA); Jersey Central Power and Light Co., Morristown, NJ (USA); Sargent and Lundy, Chicago, IL (USA). c Jun 1989. 459p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report presents the results of a site assessment study comparing steam-injected gas turbine units with combined-cycle plants. Three size categories were compared: a large plant class, nominally sized at 350-400 MW; and intermediate sized class, sized at 150 MW; and a single unit, small class nominally sized at 50-60 MW. The plants were evaluated at two Jersey Central Power and Light Company sites, one site located on a fresh water river and the other site located at a sea water site. Results of the study were reviewed and approved by a Utility Assessment Panel made up of senior utility executes. For the larger plants, 350-400 MW and 150 MW, the combined-cycle units showed a distinct economic advantage and would definitely be preferred over the steam-injected gas turbines. The economics for the small, single unit plants were much closer. The Utility Assessment Panel noted special operational benefits whereby the steam-injected gas turbine units may offer some advantage over the combined-cycle units for these small sized plants. 8 refs., 65 figs., 42 tabs.

35956 **Hybrid power system studied.** *JAPCA, International Journal of Air Pollution Control and Waste Management (USA),* 39(3): 373 (Mar 1989).

A hybrid power system that could cut electric costs by 20 percent and raise plant efficiencies to 45 percent or more is the subject of a $1.1 million study being conducted by M.W. Kellogg of Houston, Texas, for the US Department of Energy. The hybrid system uses both coal gasifier and a pressurized fluidized-bed coal (FBC) combustor to drive a high-efficiency gas turbine-generator to produce electricity. The system relies on a high velocity transport process. The gasifier converts part of the coal into a low-Btu combustible hot gas that is cleaned and sent to the turbine. The remaining coal goes to the FBC combustor in the form of char which is burned under pressure, in a rapid motion resembling a moving fluid, to produce a second source of hot gas for the turbine. By transferring the coal's heat energy directly to the turbine, the gasifier-combustor combination system provides a substantial boost in power generating efficiency. In both vessels-the gasifier and FBC combustor-a sulfur absorbing substance such as limestone is added to remove most of the sulfur pollutants. Any remaining pollutants, such as particles of ash, are removed by high temperature cleanup systems operating between the vessels and the gas turbine.

2002 Environmental Control Technology

Refer also to citation(s) 35563, 36418

35957 (DOE/PC/79856–T1) **Development of a membrane SO_x/NO_x treatment system: Final report, 28 April 1987–28 April 1988.** Membrane Technology and Research, Inc., Menlo Park, CA (USA). 1988. 41p. Sponsored by DOE Fossil Energy. DOE Contract AC22-87PC79856. Order Number DE89011416/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

A polyamide copolymer composite membrane has been developed that has outstanding properties for the removal of sulfur dioxide from flue gas. The membrane is characterized by a sulfur dioxide/nitrogen selectivity of 250 and a sulfur dioxide/carbon dioxide selectivity of 10, while the sulfur dioxide permeation rate equals 6.1×10^{-3} $cm^3(STP)/cm^2 \cdot sec \cdot cmHg$. These membrane properties have been determined with a synthetic flue gas mixture containing 0.33% SO_2, 8.2% CO_2, 5.8% O_2, 68.1% N_2, and 17.6% H_2O at 60°C. This membrane, used in a system that employs a steam sweep stream to provide the driving force for permeation, makes it possible to reduce the sulfur dioxide content of flue gas from 0.33% to 0.05% (87% removal of sulfur dioxide) at an operating cost of less than 10 mill/kWh. At the end of the program, one small spiral-wound module containing the polyamide copolymer membrane was successfully made. 26 refs., 12 figs., 19 tabs.

35958 (DOE/PC/81012–T1-Pt.1-A) **5-MW Toronto HALT [Hydrate Addition at Low Temperature] pilot plant testing: Test results: Part 1-A.** Babu, M.; College, J.; Forsythe, R.; Kerivan, D.; Lee, K.; Herbert, R.; Kanary, D. Dravo Lime Co., Pittsburgh, PA (USA). Dec 1988. 165p. Sponsored by DOE Fossil Energy. DOE Contract AC22-85PC81012. Order Number DE89012483/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

"Hydrate Addition at Low Temperature" of HALT is a dry calcium-based hydrate injection process for the removal of SO_2 from flue gases off a sulfur bearing fuel. In this process the hydrate is pneumatically conveyed and injected into the flue gas stream as a dry particulate. The flue gas is cooled downstream of the hydrate injection location by spraying the gas with a stream finely atomized water droplets. The water is atomized into a fine spray mist by using air under pressure as the atomizing fluid. The spray nozzles are specially designed. A 5MW pilot HALT was designed, constructed and operated to demonstrate the viability of the HALT process. The unit was designed to use a baghouse for particulate removal. A rented ESP was used for a pre-scheduled test period for comparison with the baghouse. Tests were conducted to cover all of the following variables: humidification, stoichiometric ratio, approach temperature, flue gas velocity, inlet flue gas SO_2 concentration, and inlet flue gas temperature. Solids samples of hydrates disposal and ESP waste solids were chemically analyzed and are reported. Hydrate samples were analyzed for particle size distribution and surface area. A two month long duration test operating 24 hours/day was successfully concluded. EPA leachate tests were conducted on the solids waste. Corrosion tests were conducted on coupons installed in the baghouse. 79 figs., 5 tabs.

35959 (EPRI-GS–6382) **Design guidelines for a furnace sorbent injection waste management system: Final report.** Lees, M.G.; Saylor, D.K.; Schoedel, A.E.; Stewart, M.M. Electric Power Research Inst., Palo Alto, CA (USA); Baker/TSA, Inc., Coraopolis, PA (USA). c Jun 1989. 737p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Furnace Sorbent Injection (FSI) is a commercially available and applied retrofit technology used to control SO_2 emissions. This report presents technical guidelines for designing and operating the waste management system of an FSI facility equipped to burn coal. Waste transfer, storage, pretreatment/conditioning, transport, and disposal are addressed. These guidelines are based on current FSI waste management practices and associated operating problems as well as critical waste properties (e.g., chemical constituents, gradation, density, moisture content, flowability, strength, leachate properties, etc.). Consequently, the report briefly describes the waste management practices of six existing or planned utility installations and two industrial facilities using bituminous coal as their primary fuel source. Results of waste property tests conducted as part of this study, and test data from other studies are reported and compared. Conceptual designs of retrofit FSI waste management systems are presented to demonstrate the economic impact of FSI on waste management. Parametric cost sensitivity analyses illustrate the impact of significant design parameters on waste management costs. 136 refs., 93 figs., 58 tabs.

35960 (EPRI-GS–6438) **Trace metal removal by iron coprecipitation: Field evaluation: Final report.** Manzione, M.A.; Merrill, D.T. Electric Power Research Inst., Palo Alto, CA (USA); Brown and Caldwell, Pleasant Hill, CA (USA). c Jun 1989. 379p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Many trace elements found in coal-fired power plant wastewaters are designated as priority pollutants by the USEPA. These include beryllium, cadmium, copper, chromium, lead, nickel, and zinc. This report presents the results of a field demonstration of the iron adsorption/coprecipitation process at the Pennsylvania Power and Light (PP and L) Company's Montour Steam Electric Station in Washingtonville, Pennsylvania. The study focused on removing many of the above-mentioned trace elements from several waste streams, including ash pond effluent, air heater wash, coal pile drainage, and leachate from a dry fly ash landfill. The study's objectives were to verify previously derived laboratory results, confirm technological and economical feasibility, and develop information that could be used to design and estimate costs of full-scale systems. The treatment technology was tested at pilot scale (10 gpm) in a continuous system under field conditions. The study examined the roles of pH, iron, and polymers in trace element removal. Investigators also studied sludges produced by the treatment process. This report describes methods for predicting sludge production, gravity sludge thickening efficiency, and sludge dewatering effectiveness (by filter press). It also discusses the results of testing four different types of process sludge with five hazardous waste characterization procedures (the EP Toxicity, Toxicity Characteristic Leaching Procedure, and California Assessment Manual tests). Results are presented from experiments designed to simulate the interactions between iron sludges and clay liners when the sludges are buried in sludge-only landfills. Finally, a design and cost example is presented to illustrate the use of pilot results in implementation of iron treatment technology at full-scale. 59 refs., 37 figs., 65 tabs.

35961 (ORNL/TM–11197) **Characterization of fiber-reinforced particulate filters.** Stinton, D.P.; Riester, L.; Dellinger, D. Oak Ridge National Lab., TN (USA). May 1989. 41p. Sponsored by DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE89013762/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Fiber-reinforced particulate filters for high-temperature application were fabricated by a recently developed chemical vapor deposition process. Mechanical property testing of these filters revealed that fibrous materials required coating with 2 to 5 μm of silicon carbide to produce acceptable strengths and thermal shock resistance. Thinner coatings were very weak and resulted in unacceptable flexing of the filters. Thicker coatings were very strong but resulted in brittle fracture of the filters. Appropriately coated filters had both an acceptable strength and the improved damage tolerance required of particulate filters. Thermal shock and repeated pressure cycling representative of pressure pulse cleaning had no apparent effect on the burst strength of filter specimens. 19 refs., 14 figs., 1 tab.

35962 (TVA/OP/EDT–88/35) **10-MW spray dryer/ESP pilot plant test program: High-sulfur coal test phase (phase 3): Final report.** Tennessee Valley Authority, Chattanooga, TN (USA). Div. of Energy Demonstrations and Technology. Jul 1988. 329p. Sponsored by Tennessee Valley Authority. Order Number DE89014210/JAW. Available from NTIS, PC A15/MF A01 - OSTI.

The Tennessee Valley Authority, in cooperation with the Electric Power Research Institute and Ontario Hydro, evaluated a 10-MW spray dryer/electrostatic precipitator (SD/ESP) on flue gas derived from the burning of high-sulfur (approximately 4 percent) coal. The main objective of the testing was to determine the effect of the major variables on SO_2 removal efficiency and whether the spray dryer could be retrofitted before an existing ESP to meet SO_2 and particulate emission limits. Major variables affecting SO_2 removal are the approach-to-saturation temperature, lime stoichiometry, and spray dryer inlet flue gas temperature. In addition, some preliminary screening tests with an alternate lime, an alternate higher chloride coal, and a different feed system design were run. These screening tests seemed to show enhanced SO_2 removal for these alternatives, which will be evaluated further. Carbon steel and Cor-Ten A are adequate materials of construction for this facility provided necessary precautions are made to avoid air in leakage which could allow cold spots, resulting in condensation and increased corrosion. Sufficient insulation on metal surfaces is also necessary. 62 figs., 30 tabs.

35963 (TVA/PG/RD–88/40) **High-sulfur spray dryer Shawnee test program: Characterization of 10-MW spray-dryer electrostatic precipitator by-product: Final report.** McKee, J.E.; Ray, S.S. Tennessee Valley Authority, Chattanooga, TN (USA). Power Business Operations/Research and Development. Aug 1988. 67p. Order Number DE89014512/JAW. Available from NTIS, PC A04/MF A01 - OSTI.

As part of Phase III MW spray drying/electrostatic precipitator (SD/ESP) pilot plant testing, a study was undertaken to characterize the recycle waste in terms of chemical, engineering and environmental properties. Results of this study are presented herein. Since the pilot plant test plan involved evaluation of the SD/ESP over long-term baseline and diverse modes of operation, an additional objective was statistical correlation of recycle waste characteristics with operating conditions. This would allow waste characteristics to be predicted as a function of operating conditions. 4 refs., 24 figs., 7 tabs.

35964 (ZE–601G569) **Review of environmental monitoring equipment for air, water and soil systems. Vol. 2(iii)-Equipment data sheets. Record #529-586, user and utility information records.** Zenon Environmental, Inc., Burlington, ON (Canada).

1989. 259p. (CE–02615). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The objectives of this study were to review the state-of-the-art of environmental monitoring equipment suitable for the utility industry, to prepare an equipment database and to identify areas where further research is needed. A review of instrumentation for air, water, and soil monitoring applications was carried out based on a survey of manufacturers and suppliers. Hard copies of equipment data sheets for data handling equipment, generated from the survey of manufacturers and suppliers and of users' experience, comprise the first part of this volume. Next listed are data sheets of 163 pollution monitoring installations in utility plants across Canada, giving equipment information and performance data. Finally, data sheets of 38 utility plants across Canada list basic plant information and environmental parameters monitored.

35965 (ZE–601G569) **Review of environmental monitoring equipment for air, water and soil systems. Vol 2(II)-Equipment data sheets. Record #247-528.** Zenon Environmental, Inc., Burlington, ON (Canada). 1989. 282p. (CE–02614). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The objectives of this study were to review the state-of-the-art of environmental monitoring equipment suitable for the utility industry, to prepare an equipment database and to identify areas where further research is needed. A review of instrumentation for air, water, and soil monitoring applications was carried out based on a survey of manufacturers and suppliers. Hard copies of equipment data sheets generated from the survey of manufacturers and suppliers and of users experience comprise this volume, which covers measuring equipment (air-ambient, air-source, meteorological, soil, water).

35966 (ZE–601G569) **Review of environmental monitoring equipment for air water and soil systems. Vol. 2-Environmental monitoring equipment database.** Zenon Environmental, Inc., Burlington, ON (Canada). 1989. 340p. (CE–02613). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The objectives of this study were to review the state-of-the-art of environmental monitoring equipment suitable for the utility industry, to prepare an equipment database and to identify areas where further research is needed. A review of instrumentation for air, water, and soil monitoring applications was carried out, based on a survey of manufacturers and suppliers. This volume first presents the Environmental Monitoring Equipment Database. The dBase III database management system was used to store the information and also to provide limited access to the information through a program employing a menu system. Instructions on the use of the database are given. Hard copies of equipment data sheets generated from the survey of manufacturers and suppliers and of users experience comprise the rest of this volume. These data sheets are presented as follows: sampling equipment (air-ambient, air-source, soil-including solid waste-and water); and measuring equipment (air-ambient, air-source, meteorological, soil, water). Indexes of equipment suppliers, manufacturers, equipment type, and parameters measured are also included. This volume covers database records 1-246. 11 tabs.

35967 (ZE–601G569) **Review of environmental monitoring equipment for air, water and soil systems. Vol. 1 - Instrument review.** Zenon Environmental, Inc., Burlington, ON (Canada). 1989. 300p. (CE–02612). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MENBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The objectives of this study were to review the state-of-the-art of environmental monitoring equipment suitable for the utility industry, to prepare an equipment database and to identify areas where further research is needed. A review of instrumentation for air, water, and soil monitoring applications was carried out, based on a survey of manufacturers and suppliers. Airborne emissions contribute the heaviest load to the environmental impact from a generating station, and, as a result, have received the greatest attention. A variety of instrumentation and monitoring equipment is available for meteorological, ambient and source monitoring purposes. Continued use of on-line monitoring equipment is practiced for the key parameters, and new developments are constantly being evaluated to improve process reliability and sensitivity. Water monitoring instrumentation has received less interest; however, new regulations may initiate additional developments in on-line instrumentation. Emphasis is directed towards the development of suitable sampling procedures and protocols to facilitate the collection of representative samples during longer-term monitoring programs. Aside from groundwater and soil atmosphere monitoring, on-line analysis of soil or solid waste is not yet technically and economically feasible. Specific research needs for each matrix and each parameter are presented and assessed. 201 refs.

2003 Power Transmission and Distribution

Refer also to citation(s) 36895, 36901, 36930, 36931, 36933, 36938

35968 (BCHPA–117-D-311) **Water treeing as a function of moisture present in XLPE cable insulation.** Abdollal, K. British Columbia Hydro and Power Authority, Surrey, BC (Canada). 1987. 49p. (CE–02632). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

Metal/polyethylene laminates (metal/PE) moisture barriers are now being used to reduce the harmful effects of water treeing in solid dielectric cables. However, the metal/PE barriers are not quite hermetic. Over a period of 10 years of operating the cable in a wet environment, a certain amount of moisture will diffuse through the barrier seal. The purpose of this project was to develop a test for the performance evaluation of cross-linked polyethylene (XLPE) cables with metal/PE barriers in the presence of these small amounts of moisture. The test program was carried out on 15 kV dry cured XLPE insulated cable having an Aluminum/polyethylene laminate moisture barrier. The rate of moisture uptake was measured for the cable components and a procedure was developed for introducing known amounts of moisture into cable samples with sealed termination. A one year aging test (at 26.3 kV, 60 Hz, room temperature) was performed on a total of 30 samples containing different amounts of moisture. This was followed by ac breakdown and water tree counts. The results of the study show that small amounts of moisture (105 g/km) introduced into a cable with a moisture barrier does not result in water tree growth and has no significant effect on the electrical performance of the cable. In contrast, cables saturated with water undergo a significant degradation due to water treeing. Based on the results of this study it is concluded that metal/PE barriers can be very effective in reducing the ingress of moisture in the cable and virtually eliminating the harmful effects of water trees. 15 refs., 14 figs., 4 tabs.

35969 (DOE/RA/50153–3) **Study of electric field and ion effects of HVDC [high voltage direct current] transmission lines: Characterization of the electrical environment beyond the corridor: Final report.** General Electric Co., Lenox, MA (USA). High Voltage Transmission Research Center. May 1989. 336p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-80RA50153. Order Number DE89014786/JAW. Available from NTIS, PC A15/MF A01 - OSTI; GPO Dep.

The Department of Energy, Division of Electric Energy Systems, initiated a research program in 1977 at the High Voltage Transmission Research Center to study the electrical environment associated with high voltage direct current (HVDC) overhead power transmission lines. The work described in this report was performed at the High Voltage Transmission Research Center (HVTRC) in Lenox, Massachusetts, during the period 1984–1988, using test facilities and instrumentation developed on behalf of the Department of Energy during the present phase of this research and during the previous phase of the research. 213 figs., 22 tabs.

35970 (IREQ–137-D-374) **Cyclic loading for distribution cables in duct banks, Vol. 4.** Bedard, N.; Raymond, R. Institut de Recherche d'Hydro-Quebec, Varennes, PQ (Canada). 1987. 54p. (CE–02629). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

This report presents the results of experimental and theoretical investigations involving the development and testing of a computer program for cable thermal calculations. An existing distribution duct bank was equipped and reinstrumented to conduct the necessary measurements on a full-scale cable installation. Another experimental installation was built to conduct tests on direct-buried cable. A laboratory mockup consisting of a 2-m single-duct installation was also built to verify the heat-flux distribution pattern around the cable-retaining duct obtained by theoretical development. The experimental results in the direct-buried and duct bank installations as well as the accurate heat flux distribution around the inside surface of the cable-retaining duct were used to create and test a comprehensive set of programs for current-carrying capacity calculations. 2 refs., 30 figs., 2 tabs.

35971 (IREQ–180-D-442) **Power line fault probabilities.** Desrochers, G.; Audette, L.; Blanchard, M.; Gagnon, C.; Proulx, R. Institut de Recherche d'Hydro-Quebec, Varennes, PQ (Canada). 1986. 157p. (CE–02637). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

Protection of communication equipment located close to electrical power systems is currently designed on a worse case basis. A methodology for risk quantification based on the probability of fault-current magnitudes at any point in the system would allow the design of less costlysystems. This project developed a methodology for computing this probability function. The function was implemented in a computer program, the Power Line Fault Probability Program. The program was tested against a typical distribution feeder. The capability of the program to tackle large systems was demonstrated by an analysis of Hydro-Quebec's high-voltage transmission system. 9 refs., 26 figs., 15 tabs.

35972 (IREQ–261-T-508) **Effect of oil viscosity on transformer loading capability at ambient temperatures below 0^0C.** Langhame, Y.; Aubin, J. Institut de Recherche d'Hydro-Quebec, Varennes, PQ (Canada). 1986. 35p. (CE–02628). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

When a transformer is operated under overload conditions, the limiting factor is usually the temperature of the hottest spot in the winding. Loading guides such as American National Standards Institute (ANSI) C57.92 provide the operator with a set of tables indicating the acceptable load factor as a function of a predetermined loss of 0^0C because they do not take accoutn of variations in oil viscosity and winding resistance. The thermal model proposed in this study allows the transient or steady-state hot-spot temperature to be calculated for any combination of load factor and ambient temperature down to -40^0C. The thermal model is applied to a typical transformer as defind in ANSI C57.92 and the calculated hot-spot temperatures compared to those yielded by the ANSI model. As the ambient temperature drops toward -40^0C, a clear divergence can be seen in the comparative results. This comes as no surprise, since the effect of oil viscosity was expected to have a strong influence at such low temperatures. However the results confirm that, for transformer with natural oil circulation, the ANSI model can be used down to -20^0C without any special modification to take account of oil-viscosity variations. 6 refs., 13 fig., 4 tabs.

35973 (MU/CRT–591) **A planning model for electrical power distribution grids.** Benchakroun, A. Montreal Univ., PQ (Canada). Centre de Recherche sur les Transports. 1988. 175p. (In French). (MICROLOG–89-00132). Available from Centre de recherche sur les transports, Universite de Montreal, CP 6128, Succursale A, Montreal, PQ, Canada H3C 3J7; $N/C.

In this thesis, the problem of the planning of electrical energy distribution was considered. A detailed mathematical model was devised, representing the fundamental characteristics of a radial power distribution grid. The costs of setting up and maintaining the equipment, as well as the costs due to power losses on-line were incorporated into the model. Contrary to existing models, this model introduces the concept of the utilization of a connector at a given time instead of the usual concept of the construction of a connector at a given time. The result is a non-linear programming problem involving continuous and discontinuous variables. Theorems were demonstrated which lead to a wholly linear problem, equivalent to the non-linear one. It was demonstrated that this new problem satisfied all the conditions required for applying the generalized Benders method. This method requires a workable initial solution; a way to extend the initial grid so as to obtain a good workable solution was proposed, and other constructive approaches were also mentioned. A flow problem at minimal cost, with a constraint of radiality, was encountered, for which 2 methods of resolution were provided. The problem was split into a sub-problem and a master problem. The resolution of the sub-problem was shown to be commonplace; the master problem was solved using the 200/XMP software. The applications of this research work were discussed. 41 refs., 13 figs., 18 tabs.

35974 (OH/RD–205-D-406) **TV interference study on distribution test line.** Reichman, J.; Hatanaka, G. Ontario Hydro Research Div., Toronto, ON (Canada). 1987. 108p. (CE–02626). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The two main objectives of this project were to investigate the television interference (TVI) characteristics of various types of noise sources and to verify the validity of a new proposed TVI measurement method (Canadian Electrical Association 102-D-201), using a cross section of real power line noise sources such as gap, insulator, and corona. A majority of the tests for the first objective were carried out on a specially built TV and galloping test line, whereas the video tapes used for recording examples of TVI in the second part of the study were prepared in the laboratory using gap and insulator TVI. It was concluded that gap discharges from loose pole hardware are by far the strongest TVI source on wood-pole power lines and that they produce about 20-40 db more TVI than noisy and defective insulators. Regarding the signal-to-noise ratio measurements for picture quality evaluation, it was found that two relatively simple TVI measurement methods are the best parameters to be used because the much more sophisticated noise amplitude distribution overlay method proposed in CEA 102-D-201 did not outperform these simple methods. 12 refs., 60 figs., 16 tabs.

35975 (SAND–88-2932) **On the limitation of the weak-coupling assumption for crosstalk analysis in an inhomogeneous medium.** Riley, D.J.; Bacon, L.D. Sandia National Labs., Albuquerque, NM (USA). Mar 1989. 43p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89014576/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The limitation of the weak-coupling assumption for the case of two transmission lines with a common ground in an inhomogeneous medium is carefully examined in this paper. All loss is neglected and the lines are assumed to be symmetric. The analysis is based on the mathematical structure of solutions to the telegrapher's equations, and therefore quasi–TEM propagation is assumed. A relationship is found between the propagation constants associated with both the fully coupled and the weakly coupled forms of these equations which leads to a necessary condition for the validity of weak-coupling in an inhomogeneous medium. Although satisfying this condition does not prove that the lines will be weakly coupled, it is anticipated that it will be the limiting factor for many applications of general interest, such as the crosstalk of digital signals on circuit boards. Theoretical and experimental results are given in both the frequency and time domains for several stripline geometries. Closed-form solutions to the telegrapher's equations based on weak-coupling in an inhomogeneous medium are provided. 11 refs., 10 figs.

21 NUCLEAR POWER PLANTS

35976 (IAEA-TECDOC–480, pp. 33-38) **Micro-computer fault tree program as a tool for defining problems.** Wild, A. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). International Atomic Energy Agency, Vienna (Austria). Oct 1988. (CONF-8703320–: Technical committee meeting on the use of probabilistic safety assessment on personal computers for operational safety management, Vienna, Austria, 16-20 Mar 1987). In *Improving operational safety management through probabilistic safety assessment on personal computers. Report of a technical committee meeting held in Vienna, 16-20 March 1987.* Order Number DE89617155/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Numerical results from fault tree analyses are important, but the information on the logic of system failures is often even more important. It is also known that a major source of errors is an improper understanding of the factors affecting the performance and reliability of a system, and therefore fault tree analyses should be reviewed not only by experts in probabilistic techniques, but also by specialists in other related fields, such as nucleonics. Of paramount importance is also comparison of the fault tree logic with actual operating experience. Because fault trees are generally large, retrieval of information requires a suitable computer tool which should also allow some speculative analyses ("what-if-.."). A great problem in fault tree analysis is identification of cross-links. Cross-links are often missed if a fault tree becomes too big to handle and it is prematurely truncated so that cross-links due to support systems are overlooked. Or, the event coding scheme is not sufficiently defined and it is not recognized that the same factor appears on several locations of a fault tree. Use of a computer tool with extensive search and scan capabilities increases the chances for proper identification of cross-links. A suitable computer tool also reduces errors in coding of events as coding an input of fault tree data does not need to be considered a separate task, but becomes a part of the fault tree development. Also, during the design of the fault tree the analyst can directly review and restructure the tree so a better insight can be obtained in the ways a system can fail. TREE-MASTER is an example of a Fault Tree handling system for personal microcomputers which performs the tasks mentioned above. It can be used in a simple way, or a sophisticated way, depending on the needs and the experience of the user. (Abstract Truncated)

35977 (IAEA-TECDOC–480, pp. 39-52) **Use of the RELVEC code in nuclear power plant operational safety management.** Jaervinen, J. (Technical Research Centre of Finland, Espoo (Finland). Electrical Engineering Lab.); Pulkkinen, U.; Niemelae, I. International Atomic Energy Agency, Vienna (Austria). Oct 1988. (CONF-8703320–: Technical committee meeting on the use of probabilistic safety assessment on personal computers for operational safety management, Vienna, Austria, 16-20 Mar 1987). In *Improving operational safety management through probabilistic safety assessment on personal computers. Report of a technical committee meeting held in Vienna, 16-20 March 1987.* Order Number DE89617155/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

The utilization of the results and information contained in the Probabilistic Safety Analysis-models (PSA) and the results of PSA analysis in nuclear power plant safety management has become an actual problem after the completion of several PSA analyses. PSA-models include a huge amount of exhaustive information on the plants' technical systems and the designed response against the incidences at plant and system level. Traditionally this information has been used only to a minor extent in future analysis of plant safety. More or less this information has been used in daily management of nuclear power plant safety. Continuous development of reliability analysis tools has allowed use of the plant models in microcomputers in an efficient way. This paper describes the properties and advantages of the RELVEC reliability analysis code in risk assessment and especially in operational safety management. RELVEC has been developed in the Technical Research Centre of Finland (VTT) during 1980-1985. The code is available on IBM-PC and compatible microcomputers and also in VAX and CYBER computers. Reliability calculations with RELVEC are based on boolean algebra and minimal cut set technique. The special properties of RELVEC are related to the component dependency options. The dependency analysis option and its applications is described and its properties are demonstrated. The dependency option is especially suitable in maintenance and repair policy assessments and it can be used in various ways in external event analysis and as a tool for finding dependencies between systems and components. The flexible properties of RELVEC in safety related technical specifications assessment are also discussed. For example conditional failure probabilities given the unavailability of one or more redundant trains can be analysed using the flexible model editing facility of RELVEC. (Abstract Truncated)

35978 (IAEA-TECDOC–480, pp. 53-74) **Requirements and methods for a computer based information system on safety parameters and PSA for operational NPP safety management.** Balfanz, H.P. (Technischer Ueberwachungs-Verein Norddeutschland e.V., Hamburg (Germany, F.R.)); Becker, G. International Atomic Energy Agency, Vienna (Austria). Oct 1988. (CONF-8703320–: Technical committee meeting on the use of probabilistic safety assessment on personal computers for operational safety management, Vienna, Austria, 16-20 Mar 1987). In *Improving operational safety management through probabilistic safety assessment on personal computers. Report of a technical committee meeting held in Vienna, 16-20 March 1987.* Order Number DE89617155/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Based on a high level of probabilistic safety analyses of safety features prepared during licensing procedures of modern German NPP's it is intended to build a computer based information system on PSA as well as on safety parameters for NPP safety management purposes. The objectives of this information system are: A fast information system on all safety relevant features of systems and components supported by PSA methods to assess plant modifications, maintenance and test procedures; A management tool to assess the actual safety plant state due to abnormal events, e.g. safety component failures. For this purpose the system contains a data bank incorporating: safety relevant system and component data, system flow charts, fault trees, event trees, reliability data. The management tasks of this system are: processing and displaying of selected system and component data as requested by the user (plant managers) e.g. of components of actual interest; a graphic presentation of selected flow charts, fault and event trees as requested; a computer program for requantifying modified fault trees. For plant management and easy understanding purpose, information on probabilistic analyses will be illustrated as near to the actual system structure of the plant concerned as possible. Moreover, and for matters of understanding safety system performance and its importance, the requirements and assumptions of analyses as well as input and output data will be shown. The illustrations of event trees are being provided to show the structure of system functions and fault trees due to abnormal events and accident sequences. The information system can be used for qualitative and quantitative information. Furthermore this system permits updating if required, in accordance with the actual plant situation and experience by modifying the input data of adding new information into the data bank. (author). 3 figs, 2 tabs.

35979 (IAEA-TECDOC–480, pp. 75-82) **Practical use of personal computer based methods for NPP operational safety assessment.** Hollo, E. (Villamosenergiaipari Kutato Intezet, Budapest (Hungary)). International Atomic Energy Agency, Vienna (Austria). Oct 1988. (CONF-8703320–: Technical committee meeting on the use of probabilistic safety assessment on personal computers for operational safety management, Vienna, Austria, 16-20 Mar 1987). In *Improving operational safety management through probabilistic safety assessment on personal computers. Report of a technical committee meeting held in Vienna, 16-20 March 1987.* Order Number DE89617155/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Level-I PSA of PAKS Nuclear Power Plant with the aim of enhancing its operational safety was initiated in Hungary in 1985. Within this work a probabilistic model of the plant related to different initiating events and operational assumptions is being set up and analyzed according to basic PSA procedures. Initially main frame computer codes were used for both qualitative and quantitative analysis. Presently effort is being made to transfer well-proved

generic codes into IBM PCs and, simultaneously, to develop specific ones for personal computers. As a result, a mixed (main frame and PC) code set is recently being used for PSA purposes. The paper presents a summary of the used software methodology with special emphasis on input/output considerations of different codes. State-of-the-art of the PC package development for fault tree analysis and generic data management is given. Case studies for demonstration of practical applications with lessons learned and addressing problem areas are discussed. (author). 7 refs, 1 fig.

35980 (IAEA-TECDOC–480, pp. 83-94) **SALP-PC - A fault tree code on personal computer for plant safety assessment.** Contini, S. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Poucet, A. International Atomic Energy Agency, Vienna (Austria). Oct 1988. (CONF-8703320–: Technical committee meeting on the use of probabilistic safety assessment on personal computers for operational safety management, Vienna, Austria, 16-20 Mar 1987). In *Improving operational safety management through probabilistic safety assessment on personal computers. Report of a technical committee meeting held in Vienna, 16-20 March 1987.* Order Number DE89617155/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

The interactive program package SALP-PC for fault tree analysis, developed on an Olivetti M24 personal computer (IBM compatible), is written in Fortran-77 to guarantee the maximum portability. It is composed of five processors, implementing the different phases of the fault tree analysis procedure. Allowed logical operators are AND, OR, NOT, K/N, XOR and INH. Boundary conditions can also be defined to obtain fault trees conditioned to the state of one or more components. The possibility to define incompatible events is also allowed. An extensive check on input data is performed. At each step of the analysis the user can restart, with modified input parameters, without having to repeat the previous steps. The minimal cut sets (MCSs) are obtained by reducing the tree according to the bottom-up technique. To save computer time the approach of determining only the most significant MCSs has been adopted, which implies the assessment of an estimate of the contribution of the non significant MCSs to the system failure. Other methods have been implemented to reduce both computer time and memory space as, for instance, the modularization and the application of the minimization procedure only when strictly necessary. This paper contains the description of the main characteristics of the program, the analysis procedure on which it is based and the developments being carried out. (author). 2 refs, 3 figs, 1 tab.

35981 (IAEA-TECDOC–480, pp. 95-99) **CYRO - A fault tree analysis code for personal computers.** Armas, A. (Optiplant S.A., Madrid (Spain)). International Atomic Energy Agency, Vienna (Austria). Oct 1988. (CONF-8703320–: Technical committee meeting on the use of probabilistic safety assessment on personal computers for operational safety management, Vienna, Austria, 16-20 Mar 1987). In *Improving operational safety management through probabilistic safety assessment on personal computers. Report of a technical committee meeting held in Vienna, 16-20 March 1987.* Order Number DE89617155/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CYRO is a fault tree analysis programme specifically designed for use on Personal Computers (PC's). The programme handles explicitly the set of Boolean equations corresponding to a fault tree and determines the equivalent Boolean expression in terms of minimal cutsets or prime implicants. The programme contains also a simple probability calculation model. This model can be used for probability truncation of low probability cutsets and for the assessment of the failure probability of the system considered with the fault tree. (author). 1 ref, 1 fig, 3 tabs.

35982 (IAEA-TECDOC–480, pp. 101-120) **RELTREE - A PC program for fault tree construction, documentation and analysis.** Berg, U. (Relcon AB, Sundbyberg (Sweden)). International Atomic Energy Agency, Vienna (Austria). Oct 1988. (CONF-8703320–: Technical committee meeting on the use of probabilistic safety assessment on personal computers for operational safety management, Vienna, Austria, 16-20 Mar 1987). In *Improving operational safety management through probabilistic safety assessment on personal computers. Report of a technical committee meeting held in Vienna, 16-20 March 1987.* Order Number DE89617155/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

RELTREE is a computer code for fault tree construction, documentation and analysis which has been developed for use on IBM- or IBM-compatible personal computers. The code includes an interactive graphic fault tree construction module, an editor for input of reliability data bases, and an analysis module. The analysis module can determine minimal cut sets, calculate top event unavailability, time-dependent reliability characteristics for the top event, and basic event importance, RELTREE also includes printer and plotter routines for documentation of fault trees, data bases and analysis results. The program is completely menu-driven and is easy to use. The capacity and performance of RELTREE is sufficient to solve large and complex fault trees, and comparisons show that it can be faster and more powerful than some recognized main-frame codes. Experience from the use of RELTREE has shown that considerable savings can be made both in man-hours and in computer run-time costs when compared with the use of more traditional main-frame codes. (author). 5 refs, 6 figs, 3 tabs.

35983 (IAEA-TECDOC–480, pp. 121-135) **PRISIM - A computer program that enhances operational safety.** Fussell, J.B. (JBF Associates, Knoxville, TN (USA)). International Atomic Energy Agency, Vienna (Austria). Oct 1988. (CONF-8703320–: Technical committee meeting on the use of probabilistic safety assessment on personal computers for operational safety management, Vienna, Austria, 16-20 Mar 1987). In *Improving operational safety management through probabilistic safety assessment on personal computers. Report of a technical committee meeting held in Vienna, 16-20 March 1987.* Order Number DE89617155/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

PRISIM, a Personal Computer program for translating PSA information for those who are not PSA experts is described. PRISIM is presently in use at the Arkansas Nuclear Unit One and at the Peach Bottom nuclear power plants with the purpose of aiding operational safety management. (author). 18 figs, 1 tab.

35984 (NUREG–0020-Vol.13-No.5) **Licensed operating reactors status summary report, data as of April 30, 1989.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Information Resources Management. Jun 1989. 513p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A22/MF A01 - GPO - OSTI.

The US Nuclear Regulatory Commission's monthly LICENSED OPERATING REACTORS Status Summary Report provides data on the operation of nuclear units as timely and accurately as possible. This information is collected by the Office of Information Resources Management, from the Headquarters Staff of NRC's Office of Inspection and Enforcement, from NRC's Regional Offices, and from utilities. Since all of the data concerning operation of the units is provided by the utility operators less than two weeks after the end of the month, necessary corrections to published information are shown on the the ERRATA page. This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

Refer also to citation(s) 36010, 36096, 36138, 36143, 36151, 36152, 36153, 36159, 36164, 36170, 36171, 36173, 36177, 36178, 36179, 36180, 36182, 36184, 36187, 36188, 36195, 36593

35985 (CONF-890470– III.B.1.1-III.B.1.10) **Team skills training: the critical next step at GPU Nuclear.** Coe, R.P. (General Public Utilities Nuclear Corp., Middletown, PA (USA)); Carl, D.R. Jr. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27

Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Numerous reports and articles have been written recently on the importance of team skills training for nuclear reactor operators, but little has appeared on the practical application of this theoretical guidance. The Training and Education at GPU Nuclear (GPUN) has initiated a high level of activity and commitment to team skills training. In 1987, GPUN undertook a significant initiative in its licensed operator training programs to design and develop initial and requalification team skills training. Prior to that time, human interaction skills training (communication, stress management, supervisory skills, etc) focused more on the individual rather than a group. Today, GPU Nuclear conducts team training at both its Three Mile Island (TMI) and Oyster Creek (OC) generating stations. Videotaped feedback is used extensively to critique and reinforce targeted behaviors. In fact, the TMI simulator trainer has a built-in, four camera system specifically designed for team training. Evaluations conducted on this training indicated these newly acquired skills are being carried over to the work environment. Team training is now an important and on-going part of GPUN operator training.

35986 (CONF-890470– III.B.3.1-III.B.3.17) **Effective simulator training for BWR operating crews in Japan.** Noji, K.; Isono, T.; Saito, G.; Miyakita, K.; Toeda, S.; Kobayashi, A. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The BWR Operator Training Center (BTC), established in 1971, has 2 full-scope simulators. (The third simulator is under construction and scheduled to go into use in October 1989.) These simulators are used to train all operators of BWR utilities in Japan. A high level of ability by shift crews as well as individuals is required in order to maintain the safe and reliable operation of a nuclear power plant. The team training for each shift crew, called Family Training, is conducted to upgrade team performance using the simulator. All operating crew members take part in Family Training which is a 1 day course, and each crew is trained 2 or 3 days a year. In this training, the shift supervisor submits a training plan based on the tasks laid out for his crew members, and the BTC instructors training technology contributes to the simulator exercises. Consequently, the training needs of the operating crew and BTC training know-how are fruitfully combined to achieve the most effective result. It is a good feature that BTC can conduct team training for each utility using effective methods, which are acquired and accumulated by BTC from many years of experience.

35987 (CONF-890470– V.A.4.1-V.A.4.12) **Use of statistics to monitor quality in training.** Helin, F.J. (Vermont Yankee Nuclear Power Operations, Rutland (USA)); Gardner, R.F. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The present method of examining quality in nuclear training is primarily through the use of periodic audits, usually externally done. But, the authors can control and monitor the quality of their training programs at a much lower cost and with greater efficiency by using other methods. By initiating Statistical Quality Control (SQC) methods, the data from individual exams can be used to identify strengths/weaknesses in each exam item and in the exam as a whole as well as generic weaknesses in the knowledge level of the population being examined. As an example, a brief review of a regression analysis performed at Vermont Yankee is presented. This analysis was performed in order to examine how well their licensed operator training program actually prepared their license candidates for the NRC exam. In order for the results of such a statistical analysis to actually be useful, a commitment to act on these results must come from the highest level of management. This upper level of management must realize that quality is quantitative and that statistics is only a means to that end (of improving quality). Many companies have instituted slogans as a means of improving quality. Slogans do not increase quality; only an on-going commitment to constant improvement will.

35988 (CONF-890470– V.B.2.1-V.B.2.6) **Adult learning techniques in maintenance training.** Roush, K.M. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The increased emphasis on the training of power plant personnel has provided the trainer with the resources and the opportunity to develop and implement quality training programs. Trainers must continually focus on how to present these quality programs in the most efficient and effective manner possible. Applied Adult Learning Techniques will increase the probability that training programs will be effective and efficient. Adult Learning Techniques used at Susquehanna power plant since 1978 are discussed.

35989 (EGG-M–88303) **Aging degradation of BWR feedwater and main steam lines.** Ware, A.G.; Shah, V.N.; Buescher, B.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 10p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (CONF-890721–16: Joint ASME/JSME pressure vessel and piping conference, Honolulu, Hawaii, USA, 23-27 Jul 1989). Order Number DE89009646/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper assesses the stressors causing aging degradation, the degradation mechanisms, the potential failure modes, and the inservice inspection requirements for Boiling Water Reactor (BWR) feedwater and main steam lines. The principal mechanisms responsible for age-related degradation are fatigue and erosion-corrosion. Feedwater nozzles have experienced fatigue damage caused by thermal stratification, water hammers, and flow-induced vibration. The main steam piping at fittings and discontinuities is susceptible to erosion-corrosion damage. Feedwater lines have also been damaged by vibrations and water hammer events. General Electric Company (GE) tests have shown that the feedwater and main steam lines, which are made of carbon steel, may be more susceptible to fatigue damage in a BWR environment than predicted by the ASME fatigue curves based on specimens tested in air. BWR feedwater lines have experienced less erosion-corrosion than Pressurized Water Reactor (PWR) feedwater lines because they have a higher oxygen content. 38 refs., 4 figs., 2 tabs.

35990 (EGG-M–88448) **A review of recent developments in pipe damping allowable values for United States nuclear plants.** Ware, A.G. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 10p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (CONF-890721–27: Joint ASME/JSME pressure vessel and piping conference, Honolulu, Hawaii, USA, 23-27 Jul 1989). Order Number DE89010980/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper reviews the history of allowable limits for damping in the analysis of nuclear piping since the issue of USNRC Regulatory Guide (RG) 1.61. In the early 1980s, it became clear that piping design had become too conservative, resulting in systems that had far too many supports, particularly snubbers. These supports were costly to design, install, and inspect; contributed to increased worker radiation exposure; and since snubbers sometimes failed to pass inservice inspection tests, the safety margin of the systems was reduced. A series of steps was undertaken by the PVRC to propose new damping limits, which culminated in an alternate damping allowable, called PVRC damping. This damping was later adopted as Code Case N-411 to the ASME Code. The ASME Appendix N Committee was not entirely satisfied with the PVRC recommendation. Consequently, EPRI sponsored a research project by Bechtel to review the damping data, perform a regression analysis, and recommend a permanent change to the ASME Code to replace Code Case N-411. The details of these activities are summarized in this paper. 20 refs., 13 figs., 1 tab.

35991 (EPRI-NP–6386) **Modeling hydrogen water chemistry for BWR applications: Final report.** Ruiz, C.P.; Lin, C.C.; Wong, T.L.; Robinson, R.N.; Law, R.J. Electric Power Research Inst., Palo Alto, CA (USA); General Electric Co., San Jose, CA (USA). Nuclear

Energy Div. c Jun 1989. 143p. Sponsored by Electric Power Research Institute. Available from Researach Reports Center, Box 50490, Palo Alto, CA 94300.

This report contains the results of calculated concentrations of O_2, H_2O_2 and H_2 and other hydrogen-oxygen species in various regions of the primary circuit for 9 BWRs for various concentrations of feedwater hydrogen. The calculations were performed by computer simulation using the GE-Harwell radiolysis model and compared with hydrogen water chemistry test data and results from a mass balance model. 36 refs., 57 figs., 9 tabs.

35992 (EPRI-NP–6394) **Feature-enhanced-imaging field trials: Peach Bottom Unit 3: Interim report, Phase 2.** Selby, G.; Williams, R.; Shankar, R. Electric Power Research Inst., Palo Alto, CA (USA); Jones (J.A.) Applied Research Co., Charlotte, NC (USA). c Jun 1989. 250p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Feature-based systems that combine imaging and signal analysis capabilities may be useful for nondestructive evaluation (NDE) of plant components. This report describes the field evaluation of an integrated system at a plant site during a scheduled outage for pipe weld examination to discriminate intergranular stress corrosion cracking (IGSCC) from benign, geometrical reflectors. The integrated system consisted of a personal computer (PC)-based system capable of detailed analysis of ultrasonic signal data and an in-service inspection (ISI) imaging system used in many commercial pipe examinations for IGSCC. The integrated system was trained to discriminate automatically IGSCC from other reflectors using EPRI NDE Center's inventory of field-removed samples. The methods and results of this training are described. Several classifiers were synthesized using mathematical features derived from signals that were collected to simulate field conditions. Data collection procedures were developed that required minimal operator training. Field data were collected and analyzed before and after pipe decontamination prior to pipe replacement. Automatic decision maps were generated for easier data interpretation and comparison. The field trial was conducted in October 1987–January 1988. Future activities will include collecting additional data after pipe removal to compare changes in baseline. These results will be presented in subsequent reports. 174 figs., 9 tabs.

35993 (JAERI-M–88-261) **Analysis of the CSNI/GREST core concrete interaction chemical thermodynamic benchmark exercise using the MPEC2 computer code.** Muramatsu, Ken; Kondo, Yasuhiko; Uchida, Masaaki; Soda, Kunihisa. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1989. 58p. Order Number DE89790959/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

Fission product (EP) release during a core concrete interaction (CCI) is an important factor of the uncertainty associated with a source term estimation for an LWR severe accident. An analysis was made on the CCI Chemical Thermodynamic Benchmark Exercise organized by OECD/NEA/CSNI Group of Experts on Source Terms (GREST) for investigating the uncertainty in thermodynamic modeling for CCI. The benchmark exercise was to calculate the equilibrium FP vapor pressure for given system of temperature, pressure, and debris composition. The benchmark consisted of two parts, A and B. Part A was a simplified problem intended to test the numerical techniques. In part B, the participants were requested to use their own best estimate thermodynamic data base to examine the variability of the results due to the difference in thermodynamic data base. JAERI participated in this benchmark exercise with use of the MPEC2 code. Chemical thermodynamic data base needed for analysis of Part B was taken from the VENESA code. This report describes the computer code used, inputs to the code, and results from the calculation by JAERI. The present calculation indicates that the FP vapor pressure depends strongly on temperature and Oxygen potential in core debris and the pattern of dependency may be different for different FP elements.

35994 (ORNL/tr–89/31) **Boiling water reactor.** Yokobori, Seiichi. Oak Ridge National Lab., TN (USA). 1989. 10p. Translation of Japanese Patent Application No. 60-53878, March 27, 1985. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE89013796/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document describes an invention which pertains to a boiling water reactor that is equipped with heat exchangers in the reactor pressure vessel for the purpose mainly of supplying heat.

35995 (STUDSVIK-NF-P–87-43) **Rod overpressure experiment (ROPE). Pre-project.** Schrire, D. Studsvik Nuclear, Nykoeping (Sweden). 23 Oct 1987. 31p. Order Number DE89617960/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This project was undertaken to obtain both experimental data and experience with certain experimental techniques, which were considered necessary for the multilateral Rod Overpressure Experiment (ROPE Project). A BWR segment rod was refilled after base irradiation to give a rod internal pressure in excess of the system pressure. This rod and an identical (but not refilled) reference rod were irradiated in the R2 reactor. The overpressure rod had a clad outward creep of approximately 8 μm after 20 days irradiation at 30 kW/m, but with an overall reduction in the pellet-clad gap.

35996 (STUDSVIK-STSR–11) **Test fuel rod fabrication and pre-irradiation characterization report, rod groups PK1, PK2 and BK7: Studsvik Super-Ramp Project.** Lorz, E. (comp.). Studsvik Energiteknik AB, Nykoeping (Sweden); Kraftwerk Union A.G., Erlangen (Germany, F.R.). Hauptbereich Brennstoffkreislauf. 31 Mar 1981. 56p. Sponsored by DOE Nuclear Energy. DOE Contract FG06-80ET34032. Order Number DE89013236/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; GPO Dep.

KWU/CE are supplying a total of 16 PWR and 8 BWR test fuel rods from the Studsvik SUPER-RAMP Project in the years 1980 and 1981. In addition to the eight PWR rods of groups PK4 and PK6 delivered in 1980, eight PWR rods divided into the groups PK1 and PK2, as well as eight BWR rods of rod group BK7 will be delivered to Studsvik in 1981. Supply of the PWR rods includes one additional spare rod for each group. The PK2 rods were fabricated and characterized during fabrication in the first half of the year 1976. The irradiation in the nuclear power plant Obrigheim (KWO) started in June 1976. In the following year, 1977, the PK1 rods were fabricated, characterized and inserted into the KWO core. The irradiation of both rod groups PK1 and PK2 was terminated by June 1980. The eight BWR test fuel rods which constitute the rod group BK7 were fabricated and characterized in 1974. The irradiation in the nuclear power plant Wuergassen (KWW) started in May 1975, and ended in December 1980. This report presents the data package on fabrication and characterization and manufacturing outline for the rod groups PK1, PK2 and BK7.

35997 (STUDSVIK-STSR–17) **Base irradiation history and interim inspection of the BWR test fuel rods of rod group BK7: The Studsvik Super-Ramp Project.** Jumlt uttner, A. Studsvik Energiteknik AB, Nykoeping (Sweden); Kraftwerk Union A.G., Erlangen (Germany, F.R.). Hauptbereich Brennstoffkreislauf. Feb 1982. 39p. Sponsored by DOE Nuclear Energy. DOE Contract FG06-80ET34032. Order Number DE89013242/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.

Eight short BWR test fuel rods (rod group BK7) have been supplied by KWU for the Studsvik SUPER-RAMP Project. These fuel rods, assembled with six additional rods to two segmented rods of KWW standard length, were pre-irradiated in the nuclear power plant Wuergassen (Kernkraftwerk Wuergassen = KWW) Germany during four operation cycles from May 1975 to December 1980. After removal from the fuel assembly the rods were taken to the Hot Cells at Karlstein for interim inspection prior to the ramp tests at Studsvik. This report presents the detailed base irradiation history of the rods in KWW as well as the results of the interim inspection at Karlstein. 21 figs., 5 tabs.

35998 (STUDSVIK-STSR–19) **Fabrication, pre-irradiation characterization and irradiation history of GE rods, for The Super-Ramp Project: The Studsvik Super-Ramp Project.** Hendriksz, P.J.; Roden, M.E.; Rowland, T.C.; Yang, R.L. Studsvik Energiteknik AB, Nykoeping (Sweden); General Electric Co., Fairfield, CT (USA). Mar 1982. 75p. Sponsored by DOE Nuclear Energy. DOE Contract FG06-80ET34032. Order Number DE89013244/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; GPO Dep.

The General Electric Company is supplying a total of eight (8) fuel rods for the Super Ramp Project. These eight fuel rods are from the segmented test rod (STR) assembly in the Monticello Boiling Water Reactor (BWR). Monticello is owned and operated by Northern States Power Co. Each of the segmented fuel rods in the 8 x 8 STR assembly was made up with four removable segments. The purpose of this report is to provide pre-irradiation, and irradiation history data for the eight GE segments. 4 figs., 9 tabs.

35999 (STUDSVIK-STSR–21) **The Studsvik Super-Ramp Project: Quarterly progress report, April–June, 1982.** Djurle, S. Studsvik Energiteknik AB, Nykoeping (Sweden). Aug 1982. 27p. Sponsored by DOE Nuclear Energy. DOE Contract FG06-80ET34032. Order Number DE89013246/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.

This is the eighth Quarterly Progress Report distributed from the Studsvik Super-Ramp Project. It covers the second quarter of 1982. The scope of the technical program for the Super-Ramp Project is an experimental investigation of the pellet-clad interaction (PCI) performance under power ramp conditions for commercial type LWR test fuel rods irradiated to high burnup. The program incorporates rods of PWR standard as well as modified designs and rods of BWR standard design. 13 refs., 3 figs., 2 tabs.

36000 (STUDSVIK-STSR–24) **The Studsvik Super-Ramp Project: Quarterly progress report, July–September, 1982.** Djurle, S. Studsvik Energiteknik AB, Nykoeping (Sweden). Nov 1982. 26p. Sponsored by DOE Nuclear Energy. DOE Contract FG06-80ET34032. Order Number DE89013248/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.

During this reporting period the Project work is behind the schedule with regard to power ramping and post-ramp examinations. In order to avoid interruptions of the power rampings, the R2 reactor system has been equipped with a more reliable safety valve device instead of an improperly functioning rupture disc system. This action has caused a delay for the remaining power rampings, thus no ramps have been performed during the third quarter. Post-ramp examinations at Studsvik have continued on the ramped W and GE rods. The main PIE work on the W rods has been completed. After transport in mid-July of all remaining KWU rods from Studsvik to Karlstein the post-ramp examinations have started at Karlstein. Minutes from the Fifth Project Committee Meeting in Sigtuna on June 10-11, 1982, have been issued as well as a status report on financial matters as of June 30, 1982 and the Eighth Quarterly Progress Report for the second quarter of 1982.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

Refer also to citation(s) 35837, 35985, 35990, 35993, 35996, 35999, 36000, 36050, 36076, 36087, 36096, 36114, 36131, 36132, 36134, 36137, 36139, 36146, 36151, 36152, 36153, 36154, 36156, 36159, 36164, 36168, 36170, 36173, 36175, 36176, 36177, 36180, 36182, 36184, 36187, 36188, 36189, 36190, 36191, 36192, 36193, 36194, 36195, 36704

36001 (CEGB-RD/L–3306/R88) **Proposals for improving interphase drag modelling for the bubbly and slug regimes in RELAP5.** Putney, J.M. Central Electricity Research Labs., Leatherhead (UK). Jun 1988. 95p. (PWR/HTWG/P–88-597). Order Number DE89618366/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

The proposal is put forward that the effective interphase drag coefficient for the bubbly and slug regimes in RELAP5 should be calculated using best-estimate void fraction correlations. It is argued that this will lead to improvements in the code's modelling of interphase drag and evidence is given to corroborate this. The need for such improvements has been prompted by the poor performance of the current models in simulating rod bundle experiments. There is also concern that the models do not account for profile slip effects, which could be important in a variety of geometries, and that the slug flow equations may not be appropriate for large diameter vertical pipes. To support the proposal, a set of void fraction correlations is identified which is believed to cover the full range of geometries and flow conditions encountered in PWR safety analysis including the analysis of small-scale experimental facilities. This set is selected from a detailed appraisal of the most appropriate correlations found in the literature which takes account of comparisons with experimental data and physical considerations. This Report forms part of the UK's commitment to the ICAP Code Improvement Plan. The recommendations will now be implemented in a development version of RELAP5/MOD3 and a preliminary assessment made. The interphase drag models used in the annular-mist regime will also be examined and, if necessary, appropriate improvements will be proposed.

36002 (CONF-890470– II.A.4.5-II.A.4.11) **Expectations for training.** Zach, J.J. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

At Point Beach Nuclear Plant, management tries to address training expectations to satisfy the various classes of customers that the Training Group has. For example, one group of customers would include the students. They may feel satisfied if the material they are presented is understandable, applicable to their jobs, and made interesting. Another customer would include senior management. They may be satisfied if the training program results in high marks from the Institute of Nuclear Power Operations and/or the Nuclear Regulatory Commission and is implemented in a very cost-effective manner. Another class of customers is the regulators and the evaluators. They may be satisfied if the training program is regimented, documented, and structured. Finally, there is the last group of people concerned, the plant management. They will be satisfied if all the other customers are satisfied, particularly those who happen to be exerting the most pressure on them at any given time.

36003 (CONF-890470– II.B.4.1-II.B.4.6) **Managing the training function.** Wiggin, N.A. (Public Safety of New Hampshire (USA)). Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

At Seabrook Station, New Hampshire Yankee has instituted the concept of a Training Advisory Council and Curriculum Advisory Committees. These two bodies (the former with fixed membership, and the latter with changing membership) are part of every phase of the Training System Development process. The Council is made up of senior management personnel, or their authorized designees, to review all training programs, including making recommendations about what is required and what is optional training. The Curriculum Advisory Committees are made up of representatives of the departments for which training is developed and implemented. These committees begin with the validation of the lists, the selection of items for training, the training settings and the initial approval of all phases of the development process. They review the design, the development, and the evaluative instruments on all the training programs. They recommend to the Council the acceptance of newly developed programs, and as necessary, the deletion or discontinuation of any program. Because they are made up of plant personnel, the process provides for the active involvement of the customer in determining training needs, directing the content, approving the objectives, and evaluating the effectiveness of the training. This paper describes how these committees were developed, how the necessary commitment was obtained and a description of one program as it passed through the process.

36004 (CONF-890470– V.B.4.1-V.B.4.22) **Evolution of technician and maintenance training.** Clifton, D.R. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

In the past five years Maintenance Training at Diablo Canyon Power Plant has evolved into a sophisticated and strongly supported organization. The key elements in the successful transition have been management support and plant specific hands-on training equipment.

36005 (CONF-890470– VI.A.3.1-VI.A.3.11) **SRO supervisory skills.** Holt, J.W. (Florida Power and Light Co., Miami (USA)). Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Over the past 4 years, St. Lucie Nuclear Plant has had 64 unplanned shutdowns of which 35 were automatic trips. Eight of these 35 automatic trips were associated with operator error. Analysis has shown that the three top causes of operator error were poor communication, poor supervisory practice, and imposed stress. Operations Training at St. Lucie has developed a countermeasure that addresses these causes and provides the supervisory skills necessary for the senior reactor operator (SRO) to be the hub of an operations crew. These skills not only apply when all operations are normal but also apply when off-normal and emergency events are in progress. St. Lucie Operations Training Department developed an approach that integrates Questioning, Intervention, Observation, and Coaching into a task called QIOC. This task is based upon an understanding of human information processing theory and represents the core of SRO supervisory skills. A classroom setting is used to describe the task and the theory upon which it is built. After being taught the theory behind QIOC, the students see practical application of its use. Through the media of video the students see control room crews in a variety of situations, from surveillance testing to emergency operations. They view the SRO's proper use of the QIOC task. The final phase of SRO Supervisory Skills training is done on the Simulator. The student practices the individual skills of QIOC through the use of Simulator Exercise Guides.

36006 (CONF-890721–23) **Impact of an apparent radiation embrittlement rate on the life expectancy of PWR [pressurized-water-reactor] vessel supports.** Cheverton, R.D.; Pennell, W.E.; Robinson, G.C.; Nanstad, R.K. Oak Ridge National Lab., TN (USA). 1989. 9p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From Joint ASME/JSME pressure vessel and piping conference; Honolulu, Hawaii, USA; 23-27 Jul 1989. Order Number DE89010258/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

Recent data from the HFIR vessel surveillance program indicate a substantial radiation embrittlement rate effect at low irradiation temperatures (~120°F) for A212-B, A350-LF3, A105-II and corresponding welds. PWR vessel supports are fabricated of similar materials and are subjected to the same low temperatures and fast neutron fluxes ($10^8 - 10^9$ n/cm^2-s, E > 1.0 MeV) as those in the HFIR vessel. Thus, the embrittlement rate of these structures may be greater than previously anticipated. A study sponsored by the NRC is under way at ORNL to determine the impact of the rate effect on PWR vessel support life expectancy. The scope includes the interpretation and application of the HFIR data, a survey of all LWR vessel support designs, and a structural and fracture-mechanics analysis of the supports for two specific PWR plants of particular interest with regard to a potential for support failure as a result of propagation of flaws. Calculations performed for one of the plants indicate best-estimate critical flaw size corresponding to 32 EFPY, of ~0.4 in. It appears that low-cycle fatigue is not a viable mechanism for creation of flaws of this size. Thus, presumably such flaws would have to exist at the time of fabrication. 19 refs., 8 figs., 3 tabs.

36007 (EPRI-NP–6410) **The plant expert system (PLEXSYS) development environment: System description and user's manual, version 2: Final report.** Hashemi, S.; Patterson, L.; Jeffery, M.; Delashmutt, L. Electric Power Research Inst., Palo Alto, CA (USA); Intellicorp, Mountain View, CA (USA). c Jun 1989. 146p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The PLEXSYS software engineering tool provides an environment with which utility engineers can build and use expert systems for power plant applications. PLEXSYS provides the engineer with access to many powerful Artificial Intelligence methodologies, while retaining an engineering frame of reference and minimizing the need for a formal background in computer science. The principle concept is that the description and understanding of power plant systems centers on graphical forms such as piping and instrumentation diagrams and electrical line diagrams, which define a graphics-based model of plant knowledge that is common to many applications. PLEXSYS provides a model editor that allows the user to construct and modify models of hydraulic, electrical, and information systems in terms of elementary components and their interconnections. Analysis of the resulting schematic models is provided by several functions that perform network analysis, schematic browsing, mathematical modeling and customization of the user interface. 41 figs., 1 tab.

36008 (INIS-SU–76, pp. 16-20) **Stratification of coolant non-isothermal turbulent flows in power plant components.** Opanasenko, A.N.; Selivanov, V.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

Using experimental models of separate components of various-type nuclear power plants, invetsigations of temperature conditions and structure of non-isothermal coolant flow under stationary and dynamic operational modes are carried out. It is ascertained that at Fr <or approx. 1 in mixing chambers, collectors, pipelines, ring gap of a tank-type reactor the coolant temperature stratification takes place, producing considerable effect on thermohydraulic characteristics of the facility. 2 refs.; 6 figs.

36009 (INIS-SU–85, pp. 54-56) **HOST optimization program complex for management of the WWER internal fuel cycle.** Simonov, V.D.; Pavlov, V.I.; Perminov, A.A.; Pechikin, V.A.; Yuskov, A.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

It is presented the HOST code complex for optimal management and prospect planning of the WWER in-core nuclear fuel cycle. The code complex allows to define assemblies for discharge, to evaluate the optimal number and enrichment of fresh fuel assemblies and to find the optimal allocation of each fuel assembly in the core by assuming a fixed properties of fuel assemblies of the previous reactor cycle and time of the next reactor cycle. The optimal decision for one cycle or a sequence of a number of equilibrium or nonequilibrium cycles may be determined. 5 refs.

36010 (JAERI-M–89-004) **Critical heat flux (CHF) characteristics of high conversion pressurized water reactor with double flat core.** Iwamura, Takamichi; Sugimoto, Jun; Okubo, Tsutomu; Murao, Yoshio. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1989. 150p. (In Japanese). Order Number DE89790901/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

Thermal-hydraulic feasibility of a high conversion pressurized water reactor (HCPWR) with a double flat core was studied from a view point of minimum departure from nucleate boiling ratio (MDNBR). The proposed HCPWR improves uranium utilization under the same electrical output as a conventional 3-loop PWR. The critical heat flux (CHF) data of Bettis Atomic Power Laboratory were used to evaluate the predictive capability of KfK, EPRI-B and W and EPRI-Columbia correlations for triangular tight lattice cores. Among them, considering a predictive erroe band of 20%, the KfK correlation had the most promising features for a design purpose. The KfK correlation was applied to COBRA-IV-I steady-state subchannel analysis of the double-flat-core HCPWR under the same boundary conditions as the 3-loop PWR. As a result, it was revealed that the MDNBR of a reference design (fuel rod diameter: 9.5mm, control rod thimble diameter: 11.0mm and rod pitch: 11.4mm) satisfied the lower limit of MDNBR for a current PWR with a sufficient margin. Parametric studies clarified that: (1) The DNBR was increased with increasing the rod pitch or decreasing the control rod thimble diameter. (2) The radial peaking factor was recommended to be less than 1.72 under

the present reference core disign. (3) A smaller fuel rod diameter required a larger pitch-to-diameter ratio (p/d) to satisfy the lower limit of MDNBR. Based on the steady-state MDNBR analysis results, the feasibility of the double-flat-core HCPWR was proved under proper considerations of core design and radial power distribution.

36011 (NUREG/CR–5350) **Mission survey for the Pressure Vessel Research User's Facility (PVRUF).** Pennell, W.E.; Pugh, C.E. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Oak Ridge National Lab., TN (USA). Jun 1989. 67p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL/TM–11133). Available from NTIS, PC A04/MF A01 - GPO - OSTI.

Description is given of a mission survey conducted as an exploratory phase of the ORNL Pressure Vessel Research Users' Facility (PVRUF) program. PVRUF is a planned open access research facility with a broad capability to perform R and D tasks necessary to bring laboratory scale PWR pressure vessel technology advances to a production status. The unique capability of PVRUF to perform this function, for a wide range of emerging pressure vessel technology advances, derives from its use of a full-scale production PWR reactor vessel as the facility test article. A full-scale prototype test article, while essential to the PVRUF mission, introduces a particular need for rigor in the facility mission definition, and the associated selection of facility features and systems. The scale of the test article dictates a matching scale in the facility features and systems. Each addition of a facility or system can thus add a significant increment to the facility mission and cost. The goal is to define the facility mission as accurately as possible at this time and to reflect the dominant reactor pressure vessel R and D needs as defined by a segment of the commercial nuclear power community. The features and systems selected for inclusion in the facility conceptual design must be closely matched to the facility mission in order to achieve a cost-effective facility design. 17 refs., 13 figs., 4 tabs.

36012 (ORNL/tr–89/28) **Reinforced confinement in a nuclear reactor.** Norman, H. Oak Ridge National Lab., TN (USA). 26 Oct 1988. 11p. Translation of Swedish Patent Application No. 8404861-0, September 28, 1984. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE89012414/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The present invention concerns a nuclear reactor containing a reactor core, a swimming pool space that is filled and pressurized with a neutron-absorbing solution, a reactor tank, at least one heat exchanger, at least one inlet line, at least one return line and at least one circulation pump, where the said reactor tank is confined in the said swimming pool space and designed to be cooled with the aid of relatively pure water, which is fed by means of the said at least one circulating pump to the said reactor tank from the said heat exchanger via the said at least one inlet line and is returned to the heat exchanger via the said at least one return line. The problem that is to be solved by the invention is to design a reactor of the above type in such a way that a complete confinement of the primary circuit of the reactor is achieved at relatively low extra cost. This problem is solved by providing the reactor with a special confinement space that confines the heat exchanger, but not the reactor tank, with the confinement space and the swimming pool space being fashioned in the same concrete body.

36013 (STUDSVIK-STSR–12) **Base irradiation history and interim inspection of the KWU/CE test fuel rods of rod groups PK 1 and PK 2: The Studsvik Super-Ramp Project.** Lorz, E. Studsvik Energiteknik AB, Nykoeping (Sweden); Kraftwerk Union A.G., Erlangen (Germany, F.R.). Hauptbereich Brennstoffkreislauf. Sep 1981. 54p. Sponsored by DOE Nuclear Energy. DOE Contract FG06-80ET34032. Order Number DE89013237/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; GPO Dep.

A total of 16 PWR type test fuel rods (segments) have been supplied by KWU/CE to the Studsvik SUPER-RAMP Project in the years 1980 and 1981. The first group delivered in 1980 consisted of eight rods of type PK 4 and PK 6. The second group is divided into 4 rods of type PK 1 and 4 rods of type PK 2 with one spare rod of each type. These rods have been supplied to Studsvik in 1981. The test fuel rods were assembled to segmented rods of standard length and pre-irradiated in the nuclear power plant Obrigheim (Kernkraftwerk Obrigheim = KWO) Germany from June 1976 (PK 2) and June 1977 (PK 1) respectively to June 1980. After removal from the fuel assembly the segmented rods were taken to the Hot Cells at Karlstein for disassembling and interim inspection prior to the ramp tests at Studsvik. This report presents the detailed pre-irradiation history of the PK 1 and PK 2 test fuel rods in KWO as well as the results of the interim inspection at Karlstein.

36014 (UCRL–100788) **A structural evaluation of the Shippingport reactor pressure vessel for transport impact conditions.** Witte, M.C.; Chou, C.K. Lawrence Livermore National Lab., CA (USA). 24 Mar 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890721–19: Joint ASME/JSME pressure vessel and piping conference, Honolulu, Hawaii, USA, 23-27 Jul 1989). Order Number DE89009920/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Shippingport Atomic Power Station in Shippingport, Pennsylvania, is being decommissioned and dismantled. This government-leased property will be returned, in a radiologically safe condition, to its owner. All radioactive material is being removed from the Shippingport Station and transported for burial to the DOE Hanford Reservation in Richland, Washington. The reactor pressure vessel (RPV) will be transported by barge to Hanford. This paper describes an evaluation of the structural response of the RPV to the normal and accident impact test conditions as required by the Code of Federal Regulations. 3 refs., 5 figs., 3 tabs.

36015 Development of HPLC techniques for the analysis of trace-metal species in the primary coolant of a pressurized-water reactor. Barron, K.R.P. Thesis (Ph. D.). 267p. Council for National Academic Awards, London, England (1988). Available from UMI, Dissertation Information Service, 300 North Zeeb Road, Ann Arbor, MI 48106.

BRDX-81,421.

The need to monitor corrosion products in the primary circuit of a pressurized water reactor (PWR), at a concentration of 10pg ml^{-1} is discussed. A review of trace and ultra-trace metal analysis, relevant to the specific requirements imposed by primary coolant chemistry, indicated that high-performance liquid chromatography (HPLC), coupled with preconcentration of sample was an ideal technique. A HPLC system was developed to determine trace metal species in simulated PWR primary coolant. In order to achieve the desired detection limit an on-line preconcentration system had to be developed. Separations were performed on Aminex A9 and Benson BC-X10 analytical columns. Detection was by post-column reaction with Eriochrome Black T and Calmagite Linear calibrations of 2.5-100ng of cobalt (the main species of interest), were achieved using up to 200ml samples. The detection limit for a 200ml sample was 10pg ml^{-1}. This study in conjunction with work carried out at Winfrith, resulted in a monitoring system that could follow changes in coolant chemistry, on deposition and release of metal species in simulated PWR water loops, On-line detection of cobalt at 11pg ml^{-1} was recorded.

2103 Power Reactors, Non-breeding, Graphite Moderated

Refer also to citation(s) 36106, 36108, 36157, 36164, 36183, 36571, 37818

36016 (INIS-SU–76, pp. 3-9) **Transients in boiling water cooled channel reactors under loss of control at low power levels.** Sabaev, E.F. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

Transients in boiling water cooled channel reactors with prevailing steam reactivity coefficients appearing under the loss of reactor control at low power levels, are considered. Classification of the

transients and their basic characteristics are given. Bifurcation diagrams are plotted and their relation to the transients is ascertained, examples of the bifurcation diagrams being provided. 3 refs.; 5 figs.

36017 (INIS-SU–84/A, pp. 3-10) **Thermal conduction of high-temperature steel foil shield for HTGR reactor.** Bol'shakov, V.I.; Kokorev, L.S.; Kudrova, L.G.; Mirenkov, A.F.; Smirnov, A.A.; Fionov, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). In *Design and construction. Scientific-technical collection.* Order Number DE89012163/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

Consideration is being given to results of calculating effective coefficient of thermal conduction of an ideal steel foil shield, specific heat flux, passing through the shield average effective coefficient of thermal conduction of a layer of thermal shield for HTGR reactor. Its dynamic characteristics are determined. 7 figs.

36018 (INIS-SU–84/A, pp. 74-80) **Calculational method for individual pipeline tracing in channel nuclear reactors.** Ufaev, N.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). In *Design and construction. Scientific-technical collection.* Order Number DE89012163/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

Computer calculational method for individual pipeline tracing in channel nuclear reactors is considered. Program, calculating individual pipeline locations is developed. The program is written in Fortran for the BESM-6 computer. 9 refs.; 4 figs.

36019 (INIS-SU–85, pp. 10-15) **Some problems on an absorber burnup in an infinite half-space.** Khodakov, V.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

The one-dimensional problem on absorber burnup in the infinite half-space under exposure to a monoenergetic neutron flux is considered. Some conditions is formulated and the cases of the problem solvability by quadrature are presented. 4 refs.

36020 (INIS-SU–85, pp. 60-62) **GAVROSh program complex abstract.** Sarychev, V.A.; Savander, V.I.; Marchuk, Yu.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

The GAVROSh code complex for pebble bed HTGR reactor core characteristics calculations is shortly described. 7 refs.

36021 (JAERI-M–88-266) **Fission products plate-out analysis code in the HTGR: PLAIN.** Baba, Osamu; Tsuyuzaki, Noriyoshi; Sawa, Kazuhiro. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1989. 64p. (In Japanese). Order Number DE89790896/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

Fission products plate-out analysis code in the HTGR, PLAIN, has been developed to calculate the plate-out distribution of high temperature gas cooled reactor. The code includes the following features: (1) The adsorption-desorption on the wall and the diffusion into the wall material are considered as a plate-out mechanism. (2) Mass transfer coefficient, adsorption rate, desorption rate, diffusion coefficient in the wall material and sublimation rate are calcualted in the code. (3) Numerical results are calculated by using Laplace inversion method. This report describes the analytical models, physical and chemical constants, numerical mehtod, users' manuals and the calculational results of experiments.

36022 (JAERI-M–88-267) **Study on the reaction between SIC and Pd, (2).** Namba, Takashi; Minato, Kazuo; Yamawaki, Michio; Fukuda, Kousaku. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1989. 19p. (In Japanese). Order Number DE89790897/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

An out of pile experiment was performed on the corrosion of the SiC layer by fission product Pd in the Triso-coated fuel particles of high temperature gas-cooled reactor. In order to clarify the corrosion mechanism, influence of Pd activity on the corrosion was studied. Seven Au-Pd alloys with different Pd contents were prepared and simulated TRISO-coated particles were heated in the powder of the alloys at 1473 and 1573K. The Pd-SiC reaction zones were observed and analyzed by XMA. From the experimental results, the reaction rate was found to be dependent on Pd activity. The dependence of the reaction rate on temperature and time was also discussed.

36023 (JAERI-M–89-006) **Graphite structural design code for the High Temperature Engineering Test Reactor.** Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1989. 42p. (In Japanese). Order Number DE89790943/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The reactor internal structures of the High Temperature Engineering Test Reactor (HTTR) are made up of mainly graphite components. The characteristics of graphite are quite different in stress-strain behavior from metals, since the ductility of graphite is significantly less than metals. Therefore, the design codes provided for metal components can not be applied directly to graphite components. The graphite structural design code for the HTTR was drafted by JAERI and reviewed by specialists outside JAERI. The design code is established mainly on the basis of JAERI's research data and by reference to the fundamental concepts of the domestic design codes for metal components. In this design code, the graphite components are categorized into the core components and core support components and the stress limits are specified separately to meet the safety requirements to each. This report presents the graphite structural design code for the HTTR which is utlized for the present design of the HTTR.

36024 (Juel–2231) **Investigation and test results of the PNP steam reformer test bundle in the EVA-II-plant.** Niessen, H.F.; Bhattacharyya, A.T.; Busch, M.; Hesse, K.; Zentis, A. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung. Aug 1988. 125p. (In German). Available from Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung.

For the development of a licensable steam reformer, arranged and operated in the primary circuit of a HTR process heat plant, a steam reformer bundle with 18 full scale tubes and a nominal power of 5 MJ/s was manufactured and successfully tested in the EVA II-plant at KFA-Juelich. With these tests under normal operation conditions and also under disturbances the thermal, process and mechanical design could be approved. The steam reformer test bundle was operated for a total time of 5200 h. During a test time of 3230 h the temperature in the helium inlet zone was in a temperature range above 900^0C. Temperature cycle experiments took additional 520 h, where the helium inlet temperature was cycled more than 100 times from 960^0C to 630^0C to 960^0C. The process parameters were varied in such a broad field, that most of today's foreseeable operation conditions of nuclear heated steam reformers are included. Within this range the test bundle fulfilled the expected data and the experimental results could be forecasted by computer simulation. The demounting of the bundle out of the steam reformer vessel was done without any difficulty. The optical impression of the bundle was very good and was confirmed by measurement. For more intensive inspection after operation and material tests the bundle will be disassembled.

36025 (OEFZS-A–1355) **HTR research and development in Austria. 1987/1988 progress report.** Proksch, E.; Neumann, W.

Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. (Austria). Dec 1988. 3p. (CH–396/88;WE–499/88). Available from the Austrian Research Centre Seibersdorf, A-2444 Seibersdorf (Austria).

Limited Distribution.

This report summarizes R and D work on high-temperature reactor fuels and high-temperature structural materials, which was performed in Austria since the 7th meeting of the International Working Group on Gas-Cooled Reactors of the IAEA. 1 ref.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

Refer also to citation(s) 35770, 36989

36026 (AECL–8632) **Advanced instrument development: a case study. Heavy water monitors: the second generation.** Keenleyside, G. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. 1985. 8p. Order Number DE89620211/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Chalk River research and development.

Heavy water is used as a moderator and heat transport medium in CANDU reactors. It is a very expensive component of the reactor and any leaking or downgrading serves to increase the cost of electric power. Precise analytical measurements of the isotopic concentrations of water samples over the entire range of D_2O concentrations are therefore vital for keeping such leaking or downgrading to a minimum. On-line isotopic analyzers offer many advantages over manual sampling; timely protection against leaks to the environment, continuous rather than discrete data for process control, accurate accounting for heavy water inventory, reduction in staff workloads, operational convenience and cost saving. This article outlines Chalk River Nuclear Laboratories' combined endeavours with Barringer Research Limited to find a viable approach to on-line D_2O monitoring at CANDU power stations and heavy water plants. The development of heavy water monitors from their initial design, the Series 400 monitors, to their current one, the Series 4600, is traced.

2105 Power Reactors, Breeding

Refer also to citation(s) 36094

36027 (CONF-890673–2) **Overview of the US program of controls for advanced reactors.** White, J.D.; Sackett, J.I.; Monson, R.; Lindsay, R.W.; Carroll, D.G. Oak Ridge National Lab., TN (USA). 1989. 31p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. From IWGFR specialists meeting on advanced controls for fast reactors; Argonne, IL, USA; 20-22 Jun 1989. Order Number DE89014776/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An automated control system can incorporate control goals and strategies, assessment of present and future plant status, diagnostic evaluation and maintenance planning, and signal and command validation. It has not been feasible to employ these capabilities in conventional hard-wired, analog, control systems. Recent advances in computer-based digital data acquisition systems, process controllers, fiber-optic signal transmission artificial intelligence tools and methods, and small inexpensive, fast, large-capacity computers—with both numeric and symbolic capabilities—have provided many of the necessary ingredients for developing large, practical automated control systems. Furthermore, recent reactor designs which provide strong passive responses to operational upsets or accidents afford good opportunities to apply these advances in control technology. This paper presents an overall US national perspective for advanced controls research and development. The goals of high reliability, low operating cost and simple operation are described. The staged approach from conceptualization through implementation is discussed. Then the paper describes the work being done by ORNL, ANL and GE. The relationship of this work to the US commercial industry is also discussed.

36028 (HEDL-TME–81-30) **Submerged gravel scrubber demonstration as a passive air cleaner for containment venting and purging with sodium aerosols—CSTF tests AC7–AC10.** Hilliard, R.K.; McCormack, J.D.; Postma, A.K. Hanford Engineering Development Lab., Richland, WA (USA). Nov 1981. 303p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-76FF02170. Order Number DE82006332/JAW. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; GPO Dep.

Four large-scale air cleaning tests (AC7–AC10) were performed in the Containment Systems Test Facility (CSTF) to demonstrate the performance of a Submerged Gravel Scrubber for cleaning the effluent gas from a vented and purged reactor containment vessel. The test article, comprised of a Submerged Gravel Scrubber (SGS) followed by a high efficiency fiber demister, had a design gas flow rate of 0.47 m^3/s (1000 ft^3/min) at a pressure drop of 9.0 kPa (36 in. H_2O). The test aerosol was sodium oxide, sodium hydroxide, or sodium carbonate generated in the 850-m^3 CSTF vessel by continuously spraying sodium into the air-filled vessel while adding steam or carbon dioxide. Approximately 4500 kg (10,000 lb) of sodium was sprayed over a total period of 100 h during the tests. The SGS/Demister system was shown to be highly efficient (removing ~99.98% of the entering sodium aerosol mass), had a high mass loading capacity, and operated in a passive manner, with no electrical requirement. Models for predicting aerosol capture, gas cooling, and pressure drop are developed and compared with experimental results.

36029 (HEDL-TME–83-12) **Submerged gravel scrubber demonstration tests: Performance of a large-scale unit.** McCormack, J.D.; Hilliard, R.K.; Postma, A.K. Hanford Engineering Development Lab., Richland, WA (USA). Dec 1984. 51p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-76FF02170. Order Number DE89013138/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; GPO Dep.

This report describes the performance of a scaled-up submerged gravel scrubber (SGS). This scrubber concept was invented by Westinghouse Hanford Company in 1978 and has been under development since that time. The SGS tested here had a design gas flow capacity of either 3.96 m^3/s (8400 cfm) or 5.65 m^3/s (12,000 cfm). These flow rates are roughly an order of magnitude larger than the design flow rate for an engineering-scale submerged gravel scrubber tested earlier. Hydraulic characteristics and aerosol trapping efficiencies were measured in a series of 12 tests. The scaled-up SGS performed as expected, based on test results from smaller-scale units. The test results confirmed the validity of the scaled-up design and verified that the SGS concept is a viable candidate for full-scale breeder reactor containment venting applications.

36030 (INIS-SU–85, pp. 66-67) **GABI program abstract.** Biryuk, G.I.; Glushkov, E.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

A description of the GABI code for neutron-physical calculation of fast nuclear reactor for two-dimensional (r,z) geometry using the 26-group nuclear data library is presented. 7 refs.

36031 (INIS-SU–85, pp. 67-69) **PRECON program abstract.** Baranov, O.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

The code for preparing 26-group neutron group constants for fast reactor calculations using the BESM-6 computer and the ARAMAKO-C1 nuclear data system is described. 4 refs.

36032 (KFK–4491) **TEGENA: Detailed experimental investigations of temperature and velocity distributions in rod bundle geometries with turbulent sodium flow.** Moeller, R. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente; Kernforschungszentrum Karlsruhe G.m.b.H.

(Germany, F.R.). Projekt Schneller Brueter. Feb 1989. 190p. (In German). Order Number DE89788355/JAW. Available from NTIS (US Sales Only), PC A09/MF A01.

Precise knowledge of the velocity and temperature distributions is necessary in fuel element design (rod bundles with longitudinal flow). The detail codes required in the fine analysis of non-uniformly cooled bundle zones are presently at the stage of development. In order to verify these computer codes, the mean fluid temperatures and the related RMS values of the temperature fluctuations were measured in a heated bundle TEGENA, containing 4 rods arranged in one row (P/D = W/D = 1.147) with sodium cooling ($Pr \simeq 0.005$). The temperature distribution in the structures was determined as the necessary boundary condition for the temperature profiles in the fluid. The experiments were carried out with different types of heating (uniform load and load tilting) and the flow conditions were varied in the range from $4000 \leq Re \leq 76.000$, $20 \leq Pe \leq 400$. The essential process of thermal development took place under uniform load within a heated bundle length of about 100 hydraulic diameters. In the main measuring plane at the end of the heated zone, after 200 hydraulic diameters, the flow can be termed largely developed thermally. There, the temperature profiles measured in the fluid exhibit pronounced maxima in the narrowest gaps of the subchannels as well as pronounced minima in the centers of the subchannels at the unheated wall. In the zones of maximum temperature gradients the temperature fluctuations attain maximum and minimum values, respectively, at the points of disappearance of the temperature gradients. In all cases of load tilting investigated the flow at the end of the heated zone had not yet developed thermally. By inspection of all thermocouples in isothermal experiments performed at regular intervals, by redundant arrangement of the mobile probe thermocouples and by demonstration of the reproducibility of results of measurement the experiments have been validated satisfactorily.

36033 (KFK–4501) **Experimental study of the phenomena of turbulent flow in the narrow gaps between subchannels of rod bundles.** Moeller, S.V. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau; Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Jan 1989. 187p. (In German). Order Number DE89788354/JAW. Available from NTIS (US Sales Only), PC A09/MF A01.

It was observed that the turbulent intensities in the narrow gaps between the subchannels of rod bundles are strongly anisotropic and higher than in pipes. In rod bundles, both the axial and azimuthal components of the fluctuating velocity have a quasi-periodic behaviour. The intensities increase with decreasing distance between the rods or between rod and channel wall, respectively. To determine the origin of this phenomenon, experiments were performed in rod bundles with different pitch-to-diameter (P/D) and wall-to-diameter (W/D) ratios. In these experiments, two components of the fluctuating velocity were measured with hot wires simultaneously at two different locations of a wall subchannel, together with the pressure fluctuations at the wall measured by microphones. The output signals were registered with an analog tape recorder. Afterwards they were digitized and evaluated to obtain spectra as well as auto and cross correlations. The results were analysed to determine the interdependence between pressure and velocity fluctuations. Attention was devoted to the analysis of turbulence spectra and the identification of their specific ranges. The dominant frequency of the turbulent motion, taken from the spectra, was found to be a function of the gap width and of the flow velocity. The corresponding Strouhal number is a geometrical parameter which can be expressed in terms of P/D and W/D. Based on the observation of transit time between the probes, measured with help of cross correlations, on the form and the presence of peaks on spectra, a phenomenological model was developed, to explain the studied phenomenon. The model describes the formation of large eddies near the gaps and their effect on the fluid motion through rod bundles. The relationship between the mixing process and the studied phenomenon was determined.

36034 (WHC-SA–0205) **Fast Flux Test Facility passive safety reactivity feedback measurements.** Knutson, B.J.; Harris, R.A.; Nguyen, D.H.; Omberg, R.P. Westinghouse Hanford Co., Richland, WA (USA). Mar 1988. 9p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-880506–29: American Nuclear Society topical meeting on the safety of next generation power reactors, Seattle, WA, USA, 1-6 May 1988). Order Number DE89011857/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A series of experiments conducted in the Fast Flux Test Facility (FFTF) measured the reactivity change between approximately 200 reactor states. The test data have been evaluated to determine the thermal hydraulic parameters of the reactor at those states. Auxiliary measurements have been analyzed to convert the measured control rod position changes to reactivity and to correct for burnup effects. The data are now available for studies of the temperature reactivity feedbacks in liquid metal reactors. Preliminary comparisons with a feedback algorithm developed from normal FFTF operation indicate that the functional form of feedbacks can be extrapolated to offnormal conditions. 1 ref., 6 figs., 3 tabs.

36035 (WHC-SA–0412) **Thermo-plastic analysis of a bowed sodium pump shaft.** Weiner, E.O. Westinghouse Hanford Co., Richland, WA (USA). Mar 1989. 7p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-890721–13: Joint ASME/JSME pressure vessel and piping conference, Honolulu, Hawaii, USA, 23-27 Jul 1989). Order Number DE89008798/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A hollow sodium pump shaft was found to have a residual bow sufficient to cause unacceptable vibrations. Investigations suggested that the bow was caused by a sodium overfill event while the pump was shut down and the shaft was not turning. A rising sodium level with natural convection effects could result in local heating of the shaft. Even though the shaft may be essentially free, a local one-sided thermal loading may cause thermal stresses and plastic stains sufficient to give a residual bow when the thermal load is removed. A series of elastic-plastic analyses were carried out to assess the likelihood of the proposed mechanism's causing the residual bow. A special purpose computer program modelled the shaft as a Bernoulli beam. Isotropic hardening was evaluated by successive approximation. For each case studied, a loading sequence was followed by an assumed elastic unloading step, and the thermal loading zone was assumed small compared to the shaft length. These simplifying assumptions allowed parameterization of several variables–yield stress, thermal loading magnitude, extent of the heated zone around the shaft circumference, temperature distribution around the circumference, and shaft unrestrained/restrained conditions. Although the magnitude of the residual bow is not centered with the solution using mean parameters of this study, it is possible that a one-sided combination of parameter values did exist and that such a condition caused the bow under the proposed mechanism. 4 refs., 12 figs.

36036 (WHC-SA–0455) **FFTF metal fuel pin sodium bond quality verification.** Pitner, A.L.; Dittmer, J.O. Westinghouse Hanford Co., Richland, WA (USA). Dec 1988. 6p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-890604–5: Annual meeting of the American Nuclear Society, Atlanta, Georgia, USA, 4-8 Jun 1989). Order Number DE89013506/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Fast Flux Test Facility (FFTF) Series III driver fuel design consists of U-10Zr fuel slugs contained in a ferritic alloy cladding. A liquid metal, sodium bond between the fuel and cladding is required to prevent unacceptable temperatures during operation. Excessive voiding or porosity in the sodium thermal bond could result in localized fuel melting during irradiation. It is therefore imperative that bond quality be verified during fabrication of these metal fuel pins prior to irradiation. This document discusses this verification.

36037 (WHC-SA–0498) **Evaluation of the advanced mixed oxide fuel test FO-2 irradiated in Fast Flux Test Facility.** Gilpin, L.L.; Baker, R.B.; Chastain, S.A. Westinghouse Hanford Co., Richland, WA (USA). May 1989. 25p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-890604–7: Annual meeting of the American Nuclear Society, Atlanta, Georgia, USA, 4-8 Jun 1989). Order Number DE89013528/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The advanced mixed-oxide (UO_2-PuO_2) test assembly, FO-2, irradiated in the Fast Flux Test Facility (FFTF), is undergoing postirradiation examination (PIE). This is one of the first FFTF tests examined that used the advanced ferrite-martensite alloy, HT9,

which is highly resistant to irradiation swelling. The FO-2 includes the first annular fueled pins irradiated in FFTF to undergo destructive examination. The FO-2 is a lead assembly for the ongoing FFTF Core Demonstration Experiment (CDE) (Leggett and Omberg 1987) and was designed to evaluate the effects of fuel design variables, such as pellet density, smeared density, and fuel form (annular or solid fuel), on advanced pin performance. The assembly contains a total of 169 fuel pins of twelve different types. The test was irradiated for 312 equivalent full power days (EFPD) in FFTF. It had a peak pin power of 13.7 kW/ft and reached a peak burnup of 65.2 MWd/kgM with a peak fast fluence of 9.9×10^{22} n/cm^2 (E > 0.1 MeV). This document discusses the test and its results. 6 refs., 19 figs., 4 tabs.

2106 Power Reactors, Auxiliary, Mobile, Package, and Transportable

36038 (JAERI-M–89-010) **Study on the optimization with shielding design of marine reactor.** Takeuchi, Kiyoshi; Itoh, Yasuyoshi; Yokomura, Takeyoshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1989. 26p. (In Japanese). Order Number DE89790946/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The primary shield should be optimized for the purpose of decreasing the radiation dose to personnel during reactor operation and also shut down. In general, the marine reactor should be designed as small as possible, which requires the minimization of the total space including the reactor and its primary shield. While for the secondary shield, its weight is overwhelmingly heavy and reaches a large percent of the total shield weight, which inevitably forces to minimize its weight. Thus, a proposal is presented for the shielding optimization with taking the respective aim described above for the primary and secondary shield into account. This proposal requires that the target dose-rate level should be set as 1/10 of the usual one behind the primary shield during reactor operation, and that the primary shield and also the shield for equipments should be designed to satisfy this new target level, resulting in that the aim of the secondary shield can be restricted to only the hypothetical accident. Consequently this proposal enables us to consider the shielding design separately for the primary and the secondary shields. On the basis of this idea, a consideration is made for decreasing the secondary shield weight by means of filling water within the container at the time of accidents, which suggests a reasonable means of decreasing the weight, although there remain still several considerations on how to filling water and the time for filling.

2107 Regulation and Licensing

Refer also to citation(s) 36055, 36056, 36064, 36123, 36124, 36133, 36135, 36162, 36165

36039 (CONF-890470– III.A.1.1-III.A.1.22) **Simulation facility evaluation program.** Hunemuller, N.K. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

As a result of Section 306 of the Nuclear Waste Policy Act of 1982, the NRC developed a requirement for nuclear power plants licensed by the NRC to have a simulation facility appropriate for conducting operator licensing tests. Such simulation facilities would be required to be available by March, 1991. These requirements are included in the revised 10 CFR 55 effective May 1987. Other guidance is located in Reg. Guide 1.149, NUREG-1258 and ANS 3.5, 1985. The evaluation program requires that a plant-referenced simulator be certified to the NRC as meeting the guidance of ANS 3.5, 1985, or that a plan be submitted for a simulation facility using alternative methods to meet the requirements of conducting an operating test. In the case of certifications to ANS 3.5, 1985 the NRC may review these certifications and, if necessary, conduct on site inspections of the simulation facility. Plans for simulation facilities which are not in accordance with ANS 3.5 must be approved by the NRC. Once a facility has a certified or approved simulation facility and an accredited requalification program based on a systems approach to training, they would no longer be required to submit details of an operator licensing applicant's training, experience and education.

36040 (CONF-890470– III.A.3.1-III.A.3.19) **Three alternative simulation systems for training nuclear power plant personnel.** Roman, C.P.; Hine, R.C.; Yeh, S.D. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Many utilities are purchasing full scope control room simulators for training purposes, but, depending upon training requirements and finances, an alternative to a full scope control room simulator may be a viable option. Westinghouse has built and delivered two styles of alternative simulation systems. Both of these systems provide real-time, plant specific simulation, and the capacity to execute all plant general, emergency, and most off-normal procedures. This paper discusses the design of both of these systems, including the design of a hybrid simulator, presently under construction, which combines features from both of these designs. In addition, some of the training capabilities and limitations for each of these simulations systems is presented.

36041 (CONF-890470– III.A.4.1-III.A.4.17) **Simulator instructor training - a case of utility teamwork.** Swander, A.J. (Virginia Electric and Power Co., Richmond (USA)). Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

To address the complex challenge of simulator instructor training, the training managers in the Southeastern States Nuclear Training Association assigned staff personnel representing each utility to develop initial simulator instructor training materials. The goal was to develop and pilot a simulator instructor training workshop that would: (1) be used by INPO for its initial simulator instructor training; and (2) would be available to all nuclear utilities. The development of training materials on how to use each utility's site-specific simulator was to be the responsibility of each utility. During the course of the year, beginning in March 1987, the team members worked through the process: table-top analysis of instructor skills; curriculum design of key lesson plans needed; the division of the topics for development among each group of participants; cross-company review of materials; editing; rewriting to establish continuity in approach; and finally, in August 1988, a pilot workshop. Nine utilities actively participated in the design and development of the materials. In preparing the abstract, a two-fold topic emerges: (1) the dynamics of the project working group; and (2) the actual finished product - the materials themselves.

36042 (CONF-890470– III.A.5.1-III.A.5.12) **New performance-based examination program for licensed reactor operators.** Cooley, R.A.; Guenther, S. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Nuclear power plant operators licensed by the US Nuclear Regulatory Commission (NRC) are required to participate in continuing (requalification) training programs sponsored by their facility licensees. The NRC has developed a new performance-based examination methodology to evaluate the proficiency and currency of power plant operators and the effectiveness of the facilities programs. This examination methodology includes an operating test and a written examination, each involving two parts. The operating test allows the examiner to observe the operators actions during simulated accident scenarios and during a plant walk-through. The simulation facility demonstration is designed primarily to evaluate the performance of the combined control room crew, while the plant walk-through evaluates individual operators abilities to correctly perform tasks (Job Performance Measures (JPMs)) that are important to safety. The two-part written examination is conducted in a static simulator and in a classroom. Both parts are administered in an open reference format in which the operators have available to

them the same reference material that they would normally have available in the control room for use in operating the plant. This allows the operators to display their ability to monitor, predict and analyze operational data and to follow procedures for accidents that may exceed the design basis of the plant. This new examination program provides a more realistic operational setting than ever before. Trials of the program were highly successful and full-scale implementation is currently underway.

36043 (CONF-890470– III.A.5.13-II.A.5.19) **Industry activities on operator requalification.** Tipton, T.E. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The Nuclear Regulatory Commission (NRC) developed a new performance-based exam program for operator requalification exams. Nuclear Management and Resources Council (NUMARC) has worked very closely with the NRC, Institute of Nuclear Power Operation, and the Regional Training Associations during the pilot phase of its development. Guidelines were developed and discussed at four co-sponsored workshops. Additionally, NUMARC sponsored a one-day industry meeting to discuss how utilities can organizationally plan methods of sharing work products to develop the operator requalification examination materials. NUMARC's Operator Issues Working Group has been directly involved in all phases of this issue. The revised requalification program was fully implemented in October 1988. NUMARC will continue to work closely with the NRC to facilitate a smooth transition into the revised process.

36044 (CONF-890470– III.B.2.1-III.B.2.11) **Lessons learned from three years of operator team skills training.** Harrington, D.K. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

It has become increasingly clear that team skills training is not just a training program, but rather an on-going learning process through which nuclear operators become increasingly aware of their behavior in a team and how that behavior either contributes to or detracts from the effectiveness of the team. As the operators continue in that process, they choose to make changes in their behavior that enhance their value to the team. This awareness does not always come easily, and it does not come from the trainer. The awareness comes as a result of the operators observing their own performance of videotape and from experiencing feedback from fellow team members, from knowledgeable facilitators, and from themselves. Team skills is currently in its infancy with many and varied possibilities for the future. While not fully supported today by the entire nuclear industry, the concept is beginning to gain wider recognition as a viable method for improving the performance of control room crews. However, for team skills to have its greatest impact in terms of plant reliability and safety, it must receive support and reinforcement from all levels of management. When the entire plant is operating as a team, everyone wins.

36045 (CONF-890470– III.B.4.1-III.B.4.10) **Frustration, the challenge and the victory of team building.** Brown, M.B. (Northeast Utilities, Springfield, MA (USA)). Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Traditionally, Team Training has been an exercise in Team Talking. The nuclear industry has never really been known for its team efforts. The Nuclear Regulatory Commission talks about the individual and that person's individual responsibility. Licensing exams evaluate the individual and on a shift basis and not as a member of a larger team. Approximately 80% of the staff functions outside of the control room. Astronauts can only get into space if the team as a whole functions well. It should be noted that those teams train together in mock launches and simulated flight. In the nuclear industry, it is believed that if the control room trains as a team, somehow the remaining 80% of the staff will function as a precision clock. This approach has failed. The time is now to champion a new approach to Team Building based on innovation and creativity.

36046 (CONF-890470– V.A.5.1-V.A.5.19) **Feasibility of quantitative performance measures for evaluating nuclear power plant operators.** Carter, R.J.; Connelly, E.M.; Krois, P.A. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

A more valid measure of team performance in nuclear power plants is needed. A study is described which was oriented towards evaluating the feasibility of synthesizing performance measures by deriving measures for crews responding to an off-normal event in a full-scope simulator. The thesis was that performance assessment is based on the subjective judgment of training instructors. The procedure used to synthesize the performance measure consisted of: identification of the factors believed to be important to performance assessment, development of example crew performances and ratings on each be instructors, and derivation of the measure by capturing the instructors assessment rules. A performance measure was derived which explains nearly all of the variance of the instructors team performance assessments. There is reason to believe that this method of synthesizing measures can be applied to other events.

36047 (EPRI-NP–6295) **Guidelines for quality records in electronic media for nuclear facilities (NCIG-10): Final report.** Domenico, W.F.; Broadus, C.R. Electric Power Research Inst., Palo Alto, CA (USA); Vanguard Technologies, Inc., Ogden, UT (USA). c May 1989. 38p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This document presents guidelines and supporting information for the creation, storage, retrieval, control and approval of quality records in electronic media for nuclear facilities. The guidelines were developed in response to a rapidly-growing trend toward the storage, maintenance and retrieval of such records on computer systems. They provide a consistent approach to the electronic creation, storage, retrieval, control and approval of quality records, a subject heretofore not addressed by industry standards and regulations. 11 refs., 1 fig.

36048 (NUREG–0750-Vol.29-No.3) **Nuclear Regulatory Commission issuances, March 1989.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services. Mar 1989. 142p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A07/MF A01 - GPO - OSTI.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

36049 (NUREG–0750-Vol.29-No.4) **Nuclear Regulatory Commission issuances, April 1989.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services. Apr 1989. 56p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A04/MF A01 - GPO - OSTI.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

36050 (NUREG–1331) **Technical Specifications, Seabrook Station, Unit 1 (Docket No. 50-443): Appendix "A" to License No. NPF-67.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation. May 1989. 413p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A18/MF A01 - GPO - OSTI.

The Seabrook Station, Unit 1 Technical Specifications were prepared by the US Nuclear Regulatory Commission to set forth the limits, operating conditions, and other requirements applicable to a

nuclear reactor facility as set forth in Section 50.36 of 10 CFR Part 50 for the protection of the health and safety of the public.

36051 (NUREG–1349) **Compilation of fastener testing data received in response to NRC Compliance Bulletin 87-02.** Cwalina, G.C.; Conway, J.T.; Parker, L.B. (comps.). Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation. Jun 1989. 104p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A06/MF A01 - GPO - OSTI.

On November 6, 1987, the Nuclear Regulatory Commission (NRC) issued Bulletin 87-02, "Fastener Testing to Determine Conformance With Applicable Material Specifications," to all holders of operating licenses or construction permits for nuclear power reactors (licensees). The bulletin was issued so that the NRC staff could gather data to determine whether counterfeit fasteners are a problem in the nuclear power industry. The bulletin requested nuclear power plant owners to determine whether fasteners obtained from suppliers and/or manufacturers for use in their facilities meet the mechanical and chemical specifications stipulated in the procurement documents. The licensees were requested to sample a minimum of 10 safety-related and 10 non-safety-related fasteners (studs, bolts, and/or cap screws) and a sample of typical nuts that would be used with each fastener and to report the testing results to the NRC. The results of this study did not indicate a safety concern relating to the use of mismarked or counterfeit fasteners in the nuclear industry, but they did indicate a nonconformance rate of 8 to 12 percent for fasteners. The NRC staff is considering taking action to improve the effectiveness of receipt inspection and testing programs for all materials at nuclear power plants.

36052 (NUREG–1354) **Fitness for duty in the nuclear power industry: Responses to public comments.** Bush, L.L.; Grimes, B.K. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Inspection and Safeguards. May 1989. 259p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A - GPO - OSTI.

The Nuclear Regulatory Commission published for public comment a proposed rule concerning the fitness for duty of commercial nuclear power plant workers (53 FR 36795). The proposed rule focused on methods for controlling the use of substances that may affect the trustworthiness and performance of workers. It provides for chemical testing, behavioral observation, employee awareness and education, and employee assistance programs as means for assuring fitness for duty. This report summarizes the comments received on the proposed rule and provides the staff resolutions of the issues raised by the comments. 3 refs.

36053 Organization of Risk Analysis Codes for Living Evaluations (ORACLE). Batt, D.L. (Idaho National Engineering Lab., Idaho Falls (USA)); MacDonald, P.E.; Sattison, M.B.; Vesely, E. v. of Probabilistic safety assessment and risk management PSA '87. Vol. 2. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). DOE Contract AC07-76ID01570. (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

ORACLE (Organization of Risk Analysis Codes for Living Evaluations) is an integration concept for using risk-based information in United States Nuclear Regulatory Commission (USNRC) applications. Portions of ORACLE are being developed at the Idaho Nationale Engineering Laboratory for the USNRC. The ORACLE concept consists of related databases, software, user interfaces, processes, and quality control checks allowing a wide variety of regulatory problems and activities to be addressed using current, updated PRA information. The ORACLE concept provides for smooth transitions between one code and the next without pre- or post-processing.

2108 Economics

Refer also to citation(s) 35755, 35827, 36009, 36039, 36040, 36041, 36042, 36043, 36044, 36045, 36046, 36066, 36133, 36135, 36136, 36140, 36141

36054 (CONF-890470– II.A.4.1-II.A.4.4) **Training: expectations of an operations superintendent.** Sellman, M.B. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The end product of all nuclear power plant operator training, initial license, and requalification, has to be operators who are able to think through and understand what is required to perform their duties. The key is thinking, and the industry needs to focus on that in operator training during the 1990's. It will take a unified effort by the utilities, INPO, and the NRC, because utilities are forced to tune their training programs to address exam questions and also to attain INPO accreditation. A qualified operator is more than one who has been trained on all of the tasks listed in the Job and Task Analysis. A qualified operator is more than one good at trivial pursuit. A qualified operator is more than one who can follow cookbook Emergency Operating Procedures. A qualified operator is one who can think through and understand what is required to perform his/her duties.

36055 (CONF-890470– II.B.3.1-II.B.3.16) **Training management systems - a comparison.** Waylett, W.J. Jr. (Florida Power and Light Co., Miami (USA)). Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The rapid growth of training programs in the nuclear utility industry over the past five years has challenged training management personnel to meet their customer's needs for effective training delivered when needed. Simultaneously, nuclear utility executives are concerned that the training process be cost-effective. The result of these forces has been the establishment of two training management systems: (1) a decentralized training management system that report to the site senior manager in order to stay close to customer needs; and (2) a centralized training management system that reports to a corporate training manager in order to be cost effective. This paper will compare the advantages and disadvantages of each training management system and will suggest methods for enhancing each system through the application of quality improvement principles.

36056 (CONF-890470– II.B.5.1-II.B.5.13) **Training management - lessons learned.** Newton, S.L. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

There has been a tremendous emphasis, rightfully so, on the incorporation of lessons learned into nuclear plant training programs for operators, technicians, and maintenance personnel. This paper will provide an opportunity to apply the lessons learned regarding training management based on observations of training organizations at over 40 plants. It will address those traits most commonly exhibited by strong training management and will provide examples of the practical application of those traits. The focus of the paper will be on the training manager and the actions he or she can take to lead an effective training organization. The premise will be developed that, in fact, the effective training manager must be more leader than manager.

36057 (CONF-890470– III.B.6.1-III.B.6.6) **Team maintenance as a result of team training.** Stone, S.K.; Lavender, D.R.; McAnulty, P.C. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Nuclear station maintenance crews have long confronted complex jobs and adverse conditions. Crews often consist of diverse station and vendor personnel who may never have worked together as a team. They are given highly technical tasks that are further complicated by radiological controls, interfacing station groups, and shift turnovers. These complications, combined with the requirements of high quality and job execution standards, tend to result in extended down-time, increased radiation exposures and considerable stress on maintenance crews. A task involving these complications is the replacement of reactor coolant pump (RCP) seals. The advantages

of reactor coolant pump seal team training are noted as follows: (1) improves job performance and reduces time required to execute seal replace; (2) improves maintenance team cooperation and minimizes inter-personnel conflicts; (3) improves interfacing group relationships and defines responsibilities; (4) improves communication and minimizes non-productive time during shift turnovers; (5) validates procedures; and (6) identifies special tooling.

36058 (CONF-890470– IV.A.3.1-IV.A.3.8) **Performance based training for quality surveillance personnel.** Edelman, G.M. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Quality surveillance in real-time is a growing industry trend to improve nuclear plant performance. However, training to support this function currently is not structured as systematically as tasking addressed through the INPO-coordinated accreditation program. This paper describes an effort by the ASQC Operations Quality Surveillance Subcommittee to produce a Quality Surveillance Handbook. The handbook will include recommendations for training content based in part on an industry-wide job analysis for the position being conducted by the subcommittee. This paper also describes a methodology for implementing a performance-based, quality surveillance program. The plan by design involves personnel who will be subject to surveillances as well as personnel who will conduct the surveillance. Design that includes both groups is the key to reducing conflict and promoting a consensus approach. Additionally, personnel must have a common process for defining weaknesses/problems and for determining corrective action.

36059 (CONF-890470– IV.A.4.1-IV.A.4.17) **Application of quality principles to training of QA audit personnel.** Glasser, W.J.; Espy, J. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

One of the major demands on nuclear QA audit programs today is their ability to determine and address the effectiveness of the activity being audited. Management wants to know with certainty whether an activity is effective or what must be done to make it effective. This demand stems largely from past experience where highly significant quality problems occurred with little, if any, forewarning by audit results. In many cases, audit results made no attempt to address effectiveness. Concurrently, a similar demand has been placed on training to teach auditors how to determine the effectiveness of an activity. This paper consists of two parts. Part 1 compares an auditor training program, developed in accordance with INPO's Training System Development methodology, with typical auditor training programs considered as satisfying ANSI N45.2.23 requirements. This comparison highlights the need to develop analytical techniques in addition to cognitive knowledge if auditing for effectiveness is to be taught. Part 2 identifies challenges encountered in implementing a skills-oriented training program for QA audit personnel and describes possible approaches for meeting these challenges. Both parts of this paper highlight those fundamental quality principles that should be ingrained into the auditor training program in order to address analytical techniques.

36060 (CONF-890470– IV.A.6.1-IV.A.6.10) **ASQC support of the quality profession in the utility industry - is it sufficient?.** Markowski, R.S. (GPU Nuclear Corp., Parsippany, NJ (USA)). Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

A professional society provides a process and a forum to provide for the recognition, nurturing and maintenance of a profession. Periodically, the professional society should evaluate whether it is providing these supportive roles to the profession as intended. About two years ago, the Education and Training Committee of the Energy Division of the American Society of Quality Control (ASQC) was reactivated. A process for characterizing the certification and/or training support that ASQC should provide to the quality profession in the utility industry is being addressed through a systematic self evaluation. The analysis phase of the Training System Design process is currently being conducted by the Education and Training Committee to formulate the body of knowledge associated with the quality engineering function in the utility industry. Once formulated that body of knowledge will be compared to that represented by the ASQC Quality Engineer and Reliability Engineer Certification Programs. That comparison should provide for a determination of the sufficiency of the ASQC certification and training support of the utility industry or suggest performance based improvements.

36061 (CONF-890470– V.A.2.1-V.A.2.24) **Managing instructor training to achieve excellence.** Norton, R.E. (Ohio State Univ., Columbus (USA)); Williams, T.M. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The requirements for instructor training in the nuclear electric power industry are clearly set forth in the August 1988 INPO 88-012, Guidelines for Instructor Training and Qualification. To be accredited and re-accredited, companies will need to address the initial and continuing instructional skills development required. The initial training of instructors presents a special challenge since only a few new instructors will be employed by most companies over the next few years. Another challenge that must be dealt with is providing individualized remedial instruction to remove performance deficiencies identified during staff evaluations. This presentation explains how a group of concerned companies formed the Electric Utility Instructor Training Consortium to address this problem in a cost-effective and time-efficient manner. It further explains how these companies collaborated with the Ohio State University to conduct job and task analysis, develop performance-based instructor modules, conduct a field review of the modules, and revise and publish the 18 modules. Further, the presentation explains how companies like Duke Power and Virginia Power have organized their instructor training programs to provide for both effective and efficient initial instructor training, advanced training, and continuing development.

36062 (CONF-890470– VI.A.2.1-VI.A.2.12) **Evaluating learning strategies in operator training programs.** Quinlan, N. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Effective and efficient operator training depends, to a large degree, on the learning strategies planned and implemented by the instructor. An understanding of recent related instructional design theories and the learning strategies that emerge from them can provide instructors with powerful tools to help operator trainees achieve success with their learning. An overview of three theories is provided. The depth of knowledge available in these theories can also be used to develop evaluation criteria to determine the effectiveness of selected learning strategies before and during lesson delivery.

36063 (IREM–86) **Dutch nuclear programme. Role of the Dutch industry.** Electrowatt Engineering Services Ltd., Zurich (Switzerland); Industriele Raad voor Energie- en Milieutechnologie (IREM), The Hague (Netherlands). Jan 1986. 142p. Order Number DE89617453/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Engineering Services Ltd. has, in fulfillment of its contractual commitment to the Dutch Industrial Council for Energy and Environment Technology (IREM), investigated the broad capability of the Dutch industry in playing a major role in the supply of goods and services for the construction of nuclear plants in the Netherlands. The findings are summarized in this document. 5 tabs.

36064 The economics of nuclear power: further evidence on learning, economies of scale, and regulatory effects. Cantor, R. (Oak Ridge National Laboratory, TN (USA)); Hewlett, J. *Resources and Energy (Netherlands),* 10(4): 315-335 (Dec 1988).

A major reason for the current problems of the nuclear industry is the unprecedented increase in construction costs over time. Cost

and leadtime data on 67 completed and nearly complete nuclear plants are used to examine the underlying sources of cost increases. The study is distinguished from other work on nuclear power costs by the approach used to derive the real, overnight construction costs. The results identify an important and overlooked relationship among size, construction leadtime, and overnight costs. 24 refs., 1 fig., 2 tabs.

22 NUCLEAR REACTOR TECHNOLOGY

36065 (INIS-SU–76) **Physics and technology of atomic reactors. Scientific-technical collection.** Voprosy atomnoj nauki i tekhniki. no. 1. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. 112p. (In Russian). Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Individual papers are processed separately for the data base. (DLC)

2201 Theory and Calculation

Refer also to citation(s) 36128, 36185, 36196

36066 (CONF-890470– VI.B.2.1-VI.B.2.5) **Degree education on-site, on-line, on-time.** Mueller, J.R. (Wisconsin Public Service Corp., Green Bay (USA)); Janke, T.A.; Fisher, J.R. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Nuclear utilities efforts in response to industry wide pressures to provide operations staff with degree opportunities have encountered formidable barriers. This paper describes the development and operation of the University of Maryland University College (UMUC) special baccalaureate degree program in nuclear science. This program has successfully overcome these barriers to provide degree education on-site, on-line, and on-time.

36067 (CONF-890470– VI.B.5.1-VI.B.5.12) **Simulator application in a nuclear technology degree program.** Sherrard, J.R. (Thames Valley State Technical College, Norwich, CT (USA)); Burchill, W.E. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Thames Valley State Technical College in Norwich, Connecticut is in its sixth year of providing an Associate's Degree Program in Nuclear Engineering Technology. A major distinguishing characteristic of this program is the use of a fundamentals nuclear reactor training simulator in the sixth (final) quarter of the curriculum. This paper describes the Thames Valley Nuclear Technology Curriculum, the Nuclear Reactor Simulator course in this curriculum, and the importance of the simulator in the application for accreditation of the Nuclear Engineering Technology Program by the Accreditation Board for Engineering and Technology.

36068 (CTA-EAv-CPD-SC–019/81) **Implatation of MC2 computer code.** Seehusen, J.; Nair, R.P.K.; Becceneri, J.C. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Atividades Espaciais. 5 Oct 1981. 35p. (In Portuguese). Order Number DE89620446/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The implantation of MC2 computer code in the CDC system is presented. The MC2 computer code calculates multigroup cross sections for tipical compositions of fast reactors. The multigroup constants are calculated using solutions of PI or BI approximations for determined buckling value as weighting function. (M.C.K.).

36069 (INIS-SU–76, pp. 20-25) **To the study of dynamics of a homogeneous reactor with circulating fuel.** Zolotarev, S.L. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

Using the BOUND program package, the dynamics of a homogeneous molten salt reactor with circulating fuel is investigated. Besides linear analysis of stability, the character of obtained boundary of stationary mode stability region is considered, and approximate values for auto-oscillations at parameters corresponding to the working mode instability region are calculated. The conclusion is made that the obtained boundary of stability region is safe over the whole considered range of parameter change, which described the distribution of neutron-physical properties of the system. A soft mode of auto-oscillation excitation is observed in the system. 11 refs.; 4 figs.

36070 (INIS-SU–76, pp. 35-41) **Systems with aftereffect in nuclear reactor dynamics.** Goryachenko, V.D. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

A brief review of studies on nonlinear mathematical models of nuclear reactor dynamics as the objects with aftereffect, caused by transport delay and other reasons, is given. Special attention is paid to works on studies of auto-oscillations in reactors. 25 refs.; 5 figs.

36071 (INIS-SU–76, pp. 57-69) **Methods and programs for calculating dynamics of thermal-hydraulics processes in nuclear reactors.** Selivanov, V.M.; Leonchuk, M.P.; Kornienko, Yu.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

Modern state and development prospects of model descriptions of the dynamics of thermophysical and hydrodynamic processes in single- and two-phase flows are considered. A brief review of existing methods and programs used in calculations of transient and emergency modes in NPPs, by-channel analysis of reactor cores, and also for solution of three-dimensional problems on determination of nuclear reactor thermohydraulic characteristics on the whole and its elements in particular, is presented. 73 refs.; 3 figs.; 2 tabs.

36072 (INIS-SU–85) **Nuclear reactor physics and technology. Scientific-technical collection.** Voprosy atomnoj najki i tekhniki. no. 2. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. 91p. (In Russian). Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Individual papers in this collection are separately indexed.

36073 (INIS-SU–85, pp. 3-10) **Approximation of the slowing-down equation solution by the discontinuous finite element method.** Sataev, E.A.; Vorotyntsev, M.F.; Rinejskij, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

Consideration is given to the problem of the slowing-down equation solution approximation employing the discontinuous finite

element method. The theorems on the convergence of the approximate solutions to the exact ones are proved, with the basis functions number being increased in two different ways. The examples of calculations are given. 9 refs.; 4 figs.; 1 tab.

36074 (INIS-SU–85, pp. 16-19) **Technique for multigroup calculation of a two-dimensional reactor in neutron energy slowing-down and thermalization ranges with burnup accounting.** Artem'ev, N.I.; Dekusar, V.M.; Kalashnikov, A.G.; Moseev, A.L. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

Technique for multigroup two-dimensional calculation of a reactor in particular containing strongly shielded burnable poisons taking into account changes in isotope composition as a result of burnup, is considered. Solution of diffusion equation in a group is based on high-efficient modification of the alternative direction method. 7 refs.

36075 (INIS-SU–85, pp. 20-24) **Difference schemes for solving the equation of the discrete ordinate method in the (Δ,Z) geometry.** Suslov, I.R. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

Two difference schemes to solve transport equations using the method of discrete ordinates in (Δ,Z)-geometry are suggested. The first one is based on linear relation between angular fluxes averaged by input and output faces and by the whole calculation cell. The second one is based on the equation integration along characteristics within the calculation cell in the assumption of equality to a constant of angular fluxes on input faces and spatially distributed sources. Results of numerical solution of the model problem show that with the net tightness the error decreases in proportion to the calculated cell side. 7 refs.; 3 figs.

36076 (INIS-SU–85, pp. 24-33) **Use of the Monte Carlo method for verification of the accuracy of modern methods for heterogeneous reactor calculations.** Gomin, E.A.; Majorov, L.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

Numerical analysis of accuracy of the surface flux method, used for the calculation of power reactor heterogeneous lattices, is carried out. Results of the calculations made for model lattices of the WWER-440 type reactors using the Monte Carlo and surface flux methods are compared, and sufficiently high accuracy of balance equations, on which the surface flux method is based, is demonstrated. However, the accuracy depends considerably on the choice of the balance equation coefficients, which in its turn is determined by the quality and detailed character of neutron spectrum apriory description in separated cells. 12 refs.; 3 figs.; 7 tabs.

36077 (INIS-SU–85, pp. 44-54) **On geometric simulating in nuclear reactor calculations by the Monte-Carlo method.** Ostashenko, S.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

Analysis of existing geometric modules makes it possible to reveal their disadvantages and to formulate requirements list, which should be satisfied by any usefull geometry system. Short description of GDL language used for complex reactor systems simulating is given. GDL language applies hierarchical representation scheme to assemblies, which aids to reduce significantly amount of input data. The language is part of GDL geometry system designed for MCU package and implemented on ES computers. 15 refs.; 10 figs.

36078 (INIS-SU–85, pp. 69-70) **ARADAR program abstract.** Glushkov, E.S.; Petushkova, N.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

A description of the ARADAR program for solution of the one-dimensional multigroup equations of reactors (cells) in P_1-approximation for plan, cylindrical and spherical geometry is presented. The program is connected automatically with the 26-group microconstant library including 46 chemical elements. 5 refs.

36079 (INIS-SU–85, pp. 71-72) **Abstract of the RADIKF and RADIKF-ES programs.** Boyarinov, V.F. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

The RADIKF and RADIKF-ES codes for calculation of few-group matrix of the diffusion coefficients in cylindrical reactor cell are shortly described. 9 refs.

36080 (INIS-SU–85, pp. 56-60) **DEMETRA-ES program.** Trukhanov, G.Ya.; Maglevannyj, I.I.; Abdullaev, Kh.Sh. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

The DEMETRA-ES code for the calculation of neutron thermalization in one-dimensional heterogeneous systems for general boundary conditions and arbitrary thermal neutron source by the quasi-diffusion method is shortly described. 13 refs.

36081 Boundary treatment of the diffusion synthetic acceleration method for fixed-source discrete-ordinates problems in x-y geometry. Valougeorgis, D. (9518410). *Nuclear Science and Engineering (USA),* 100(2): 142-148 (Oct 1988).

A study on the development of acceleration equations for boundary cells and the associated boundary conditions for the diffusion synthetic acceleration method of neutron transport problems in x-y geometry is described. Alcouffe's algebraic manipulation of the P_1 equations resulting in a single diffusion equation is modified to obtain explicit acceleration equations for the boundary cells. To accomplish this, the discretization in space is performed according to the ordinary box-centered method. The resulting synthetic computation scheme is linear in its differenced form. The boundary cell difference equations are derived in a manner that exactly parallels the discretization of the diffusion equation for interior mesh cells and that of the transport equation. The importance of these equations in improving overall efficiency without sacrificing stability is discussed, as is the optimum choice of the boundary conditions associated with these equations.

2202 Components and Accessories

Refer also to citation(s) 35841, 36063, 36129, 36142, 36144, 36166, 36172, 36588, 36991

36082 (CONF-890721–11) **An experimental study of the effect of stainless steel cladding on the structural integrity of flawed steel plates in bending.** Iskander, S.K.; Nanstad, R.K.; Robinson, G.C.; Oland, C.B. Oak Ridge National Lab., TN (USA). 1989. 17p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From Joint ASME/JSME pressure vessel and piping conference; Honolulu, Hawaii, USA; 23-27 Jul 1989. Order Number DE89008735/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A small crack near the inner surface of clad nuclear reactor pressure vessels is an important consideration in the safety assessment of the structural integrity of the vessel. Experimental results from tests on large clad and unclad plate specimens with surface flaws have shown that (1) a tough surface layer composed of cladding and/or heat-affected zone has arrested running flaws in clad plates under conditions where unclad plates have ruptured, and (2) the residual load-bearing capacity of clad plates with large subclad flaws significantly exceeded that of an unclad plate. The fracture surfaces of unclad plates suggest that the flaw evolves through alternately tunneling then breaking to the surface. In the case of clad plates, it is hypothesized that the tough, strong surface layer inhibits the tunneled flaw from propagating to the surface.

36083 (CONF-890721–12) **Evaluation of weldment creep and fatigue strength-reduction factors for elevated-temperature design.** Corum, J.M. Oak Ridge National Lab., TN (USA). 1989. 30p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. From Joint ASME/JSME pressure vessel and piping conference; Honolulu, Hawaii, USA; 23-27 Jul 1989. Order Number DE89008242/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

New explicit weldment strength criteria in the form of creep and fatigue strength-reduction factors were recently introduced into the American Society of Mechanical Engineers Code Case N-47, which governs the design of elevated-temperature nuclear plants components in the United States. This paper provides some of the background and logic for these factors and their use, and it describes the results of a series of long-term, confirmatory, creep-rupture and fatigue tests of simple welded structures. The structures (welded plates and tubes) were made of 316 stainless steel base metal and 16-8-2 weld filler metal. Overall, the results provide further substantiation of the validity of the strength-reduction factor approach for ensuring adequate life in elevated-temperature nuclear component weldments. 16 refs., 7 figs.

36084 (CONF-890721–15) **Effect of peak thermal strain on simplified ratchetting analysis procedures.** Sartory, W.K. Oak Ridge National Lab., TN (USA). 1989. 25p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. From Joint ASME/JSME pressure vessel and piping conference; Honolulu, Hawaii, USA; 23-27 Jul 1989. Order Number DE89008745/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Omission of peak strain in the O'Donnell-Porowski simplified ratchetting rules of ASME Code Case N-47, which governs design of elevated-temperature nuclear components, can lead to nonconservatism. The O'Donnell-Porowski method is therefore modified in this paper to include peak strain. The revised technique eliminates nonconservatism that was originally found in comparing the simplified rules with the results of two- and three-dimensional analyses and that was used as a basis for restricting the O'Donnell-Porowski method to one-dimensional geometries. Since the new method is found to be conservative in all the one-, two-, and three-dimensional problems in which it is has been tested, it is under consideration by the code for inclusion in N-47 without restriction as to dimensionality. 7 refs., 5 figs., 2 tabs.

36085 (CONF-890721–29) **Nonlinear behavior of a containment building during an earthquake.** Hsieh, B.J.; Kot, C.A.; Srinivasan, M.G.; Costello, J.F. Argonne National Lab., IL (USA). 1989. 15p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-31109-ENG-38. From Joint ASME/JSME pressure vessel and piping conference; Honolulu, Hawaii, USA; 23-27 Jul 1989. Order Number DE89012428/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The nonlinear behavior of a 1/4-scale containment structure subjected to strong motion earthquake excitation is investigated by analyzing acceleration measurements on the structure and the site/soil surrounding the structure. Acceleration transfer functions obtained from the ratios of Fourier Transforms provide the means to estimate the dynamic characteristics of the soil-structure system. These are compared with results obtained from low-level vibration testing of the structure. Due to strong nonlinear effects during strong-motion excitation the fundamental frequency decreases by about 40% relative to the value obtained in low-level vibration tests (2.3 vs 3.8 Hz). In addition, this frequency as well as the shape of the transfer function moduli vary considerably with time during the strong motion excitation. This preliminary investigation indicates that the analysis of earthquake responses coupled with the results of low level vibration tests provide a means to gain understanding of the nonlinear behavior of soil-structure systems during strong motion, and may lead to the improvement in the modeling of soil-structure interaction phenomenology. 8 refs., 6 figs.

36086 (EPRI-NP–6212-M) **A finite-element model for eddy-current nondestructive evaluation: Final report.** Lord, W. Electric Power Research Inst., Palo Alto, CA (USA); Colorado State Univ., Fort Collins, CO (USA). Dept. of Electrical Engineering. c Jun 1989. 100p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Eddy current nondestructive testing techniques are used widely throughout the utility industry for the early detection of defects in critical power plant components such as steam generator tubing. An important aspect of the testing procedure is the evaluation of the eddy current signals to yield information about defects in the part under test. Research effects are underway to automate this process of defect characterization and hence make it more reliable and faster than currently used techniques involving human operators. One major factor which has limited progress towards development of a viable defect characterization scheme for eddy current testing has been the lack of a general mathematical model capable of predicting the complex electromagnetic field/defect interactions in the part under test. A major objective of this research project has been to develop finite element computer code capable of modeling eddy current NDT phenomena of interest to the utilities. Results of numerical studies are described in this report which clearly show the viability of the finite element technique as a general purpose mathematical model, capable of predicting eddy current probe signals from realistic nondestructive testing situations. 43 refs., 47 figs., 5 tabs.

36087 (INIS-SU–76, pp. 25-35) **Equation derivation and studying the dynamics of NPP cooling systems.** Smirnov, L.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

It is suggested that the apparatus of analytical mechanics for bodies with variable mass should be used to obtain equations of incompressive coolant flow and to study the dynamics of NPP circulation systems. The approach is based on derivation of the Bernoulli equation for unsteady flow from the Lagrangian equation of the second type for a body a variable content like a pipeline. Equations for the main elements of the systems are derived, mathematical model of multiloop circulation system dynamics typical for the WWER reactors is presented and stability of equilibrium mode is studied. Dynamics of flow rate change in the case of switching off and subsequent run-out of one of the operating main circulation pumps (MCP) is considered, and it is shown that at the moment of the MCP cutting-off a rapid flow rate change takes place. 15 refs.; 4 figs.

36088 (INIS-SU–84/A, pp. 19-29) **Method for calculating plane reinforced concrete elements of walls and ceilings in power plant structures under limiting loads.** Smirnov, S.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). In *Design and construction. Scientific-technical collection.* Order Number DE89012163/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

General method for determining limiting loads on any plane-stressed and plane-deformed element is suggested. It is realized in details for calculating composite parts of NPP walls and ceilings, serving as stif fening diaphragms, short elements and wall beams. The method is based on revealing compressed-extended and other dangerous uniformly stressed zones by construction of equilibrium piecewise-homogeneous stress fields with minimal number of zones. General principles of constructing fields, containing plastic zones, analogous to real dangerous zones, are developed. 8 refs.; 3 figs.

36089 (INIS-SU–84/A, pp. 30-37) **Determining the carrying capability of composite plates in power plant structures taking into account attenuating effect of joints in them.** Smirnov, S.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). In *Design and construction. Scientific-technical collection.* Order Number DE89012163/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

It is proved that the presence of weak joints showed be taken into account when evaluating overall strength of NPP composite elements. Complicated character of the problem in the general case is shown. Principles and examples of solution are given for the commonest NPP elements, namely composite plates of ceilings. Formulae, enabling to take into account the influence of joint brittleness on carrying capability of such plates, are obtained. 1 fig.

36090 (INIS-SU–84/A, pp. 38-46) **Cracking and rupture of a prestressed reinforced concrete high-pressure vessel.** Nikolaev, Yu.B.; Zertsalov, M.G.; Shargorodskij, M.A.; Shipilov, Yu.Ya. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). In *Design and construction. Scientific-technical collection.* Order Number DE89012163/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

Theoretical methods for evaluating cracking in prestressed reinforced concrete high-pressure vessels of reactors are considered. Approximate evaluation of the vessel stressed state is given; possible ways of crack propagation are analyzed. 6 refs.; 4 figs.

36091 (NUREG/CR–5222) **Static load cycle testing of a low-aspect-ratio six-inch wall TRG-type structure TRG-4-6 (1.0, 0.25).** Farrar, C.R.; Bennett, J.G.; Dunwoody, W.E.; Baker, W.E. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Los Alamos National Lab., NM (USA). Jun 1989. 23p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-7405-ENG-36. (LA–11422-MS). Available from NTIS, PC A03/MF A01 - GPO - OSTI.

Quasi-static load cycle testing of a 6-in.-thick reinforced concrete shear wall structure is detailed in this report. The background of this program and results that led to this series of experiments are reviewed. Geometry of the tests structure, design parameters, preliminary modal testing and analysis to verify undamaged dynamic properties, material property tests, instrumentation ad results of this data reduction for stiffness, cracking values, and energy losses are given. Results are compared with other investigators' results as well as with the American Concrete Institute 318-349 code predictions. 32 refs., 101 figs., 11 tabs.

2203 Fuel Elements

36092 (INIS-SU–85, pp. 72-73) **ELL program abstract.** Sergeeva, L.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

The ELL code makes it possible to calculate the stressed-strained state in fuel cans both under stationary conditions and during accidents. The calculation is carried out with allowance for an initial ovality and anisotropy of fuel can properties. 5 refs.

36093 (STUDSVIK-STSR–23-Rev.) **Non-destructive examinations of PW 5 rods: The Studsvik Super-Ramp Project.** Bergenlid, U.; Birath, S.; Bivered, B.; Brisling, A.; Lysell, G. Studsvik Energiteknik AB, Nykoeping (Sweden). Dec 1982. 28p. Sponsored by DOE Nuclear Energy. DOE Contract FG06-80ET34032. Order Number DE89013249/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.

The following non-destructive examinations have been performed on four PW 5 rods: visual inspection, eddy current (EC) testing, dimensional measurement, gamma scanning, and neutron radiography. This document discusses the results of this testing.

2204 Control Systems

36094 (CONF-890673–1) **Supervisory control in a distributed, hierarchical architecture for a multimodular LMR.** Otaduy, P.J.; Brittain, C.R.; Rovere, L.A. Oak Ridge National Lab., TN (USA). 1989. 11p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. From IWGFR specialists meeting on advanced controls for fast reactors; Argonne, IL, USA; 20-22 Jun 1989. Order Number DE89014764/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes the directions and present status of the research in supervisory control for multimodular nuclear plants being conducted at Oak Ridge National Laboratory (ORNL) as part of US Department of Energy's (DOE) Advanced Controls Program. First, the hierarchical supervisory control structure envisioned for a Power Reactor Inherently Safe Module (PRISM) multimodular LMR is discussed. Next, the architecture of the supervisory module closest to the process actuators and its implementation for demonstration in a network of CPU's are presented. 12 refs., 3 figs.

36095 (EPRI-NP–6067-Vol.2) **Surveillance of instrumentation channels at nuclear power plants: Volume 2, An approach to classifying problems and solutions: Final report.** Thie, J.A. Electric Power Research Inst., Palo Alto, CA (USA); Thie (J.A.), Knoxville, TN (USA). c Jun 1989. 35p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Surveillance activities at nuclear plants, involving-calibrations, functional tests, and simple checks, have many associated problems. These problems are of the following four types: administrative, equipment, human, and systemic. An extensive search of the literature has led to 63 generic classes of problems falling within these types and involving instrumentation department activities. The classification system is that which writers of incidents are essentially using, based on historical traditions, in naming their problems' causes. An interesting finding in the search was the strong correlation of this project to many aspects of industrial safety; technology transfer opportunities from the latter are identified. A survey of plant instrumentation experts was conducted to obtain a ranking of the most important problems. Classes of solutions to these problems are listed and discussed. Outlined is a possible methodoiogy of matching these solutions to problems. Finally applications of this study are listed, and include extensions to training, operations, and maintenance departments of power plants. Appendices give several general examples for each problem class and many specific suggestions from experts on addressing the problems felt to be more important. 15 refs., 2 figs., 6 tabs.

36096 (EPRI-NP–6337) **Vibration monitoring of main coolant pumps: Guideline and reference data: Final report.** Hartlen, R.T. Electric Power Research Inst., Palo Alto, CA (USA); Ontario Hydro Research Div., Toronto, ON (Canada). c May 1989. 103p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

User needs for vibration monitoring and Diagnostics of PWR/BWR Reactor Coolant and Recirculation Pumps were identified by a survey. The required contents for a proposed computer-based

ADVISOR were specified. It addresses instrumentation, data acquisition and analysis; analytical modelling of machine dynamics; test procedures; limits for alert and action; and diagnosis. Heavy emphasis is placed on developing a fault-symptoms matrix specific to machines of the Reactor Coolant/Recirculation pumpset configuration. Also emphasized is the use of actual relevant case histories as the essential data base. Based upon information available, an initial, partial version of the ADVISOR was assembled in hard copy form. Recommendations are made for the further work required to complete the ADVISOR. This report provides the final results for EPRI Project RP1556-4. 3 refs., 1 fig., 1 tab.

36097 (IAE–4557/15) **Support system for loop device operator. Analysis of technological processes.** Yakovlev, V.V.; Mozhaev, A.A.; Lyadin, A.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1988. 32p. (In Russian). Order Number DE89620234/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The paper presents the results obtained from the analysis of controlling the loops of a research reactor. A method of optimized interaction of the operator and hardware of the control system by computeraided identification of the cause of regime violation is considered. The equipment diagnostics based on use of the expert system methods and tuzzy algorithms enables to propose a support system for application in new generation of loops. 11 refs.; 8 figs.; 15 tabs.

36098 (INFO–0247) **Computer software configuration management.** Pelletier, G. Atomic Energy Control Board, Ottawa, ON (Canada). Aug 1987. 57p. Order Number DE89620235/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

This report reviews the basic elements of software configuration management (SCM) as defined by military and industry standards. Several software configuration management standards are evaluated given the requirements of the nuclear industry. A survey is included of available automated tools for supporting SCM activities. Some information is given on the experience of establishing and using SCM plans of other organizations that manage critical software. The report concludes with recommendations of practices that would be most appropriate for the nuclear power industry in Canada.

36099 (INIS-SU–76, pp. 42-46) **Dynamics of a reactor with discrete control system under restriction on the control action value.** Postnikov, N.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

Algorithm of reactor power control, according to which the control effect is restricted and introduced in discrete time moments ntau, is studied. The value of the reactivity introduced is chosen so as to compensate in the maximum the neutron flux perturbation, appearing to the ntau time moment. It is shown that when tau parameter passes the value tau_{cr}, critical as to stability condition, the stochastic auto-oscillations appear, which are generated by the determinated system when there are no accidental parameters or accidental external perturbations in it. In the reactor parameters space the stochasticity range is determined and the maximum value of neutron flux deviation from the stationary value in the mode of steady oscillations is obtained. 5 refs.; 2 figs.

36100 (INIS-SU–76, pp. 46-57) **Reactor power stabilization using a discrete control system.** Migalov, I.V.; Postnikov, N.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

Algorithm of reactor power control, according to which control effect is introduced only in discrete time moments ntau by equal parts $+\Delta R$ or $-\Delta R$, depending on the sign of power deviation from the stationary value, is considered. It is shown that there are restricted motions in control system if the control interval tau does not exceed the critical value tau_{cr} and stochastic auto-oscillations are the only type of unsteady motions. The dependences of tau_{cr} on reactor parameters are obtained. The attracting sets (strange attractors) are obtaied. The maximum amplitude of autooscillations is determined. It is shown that by special choice of tau, ΔR parameters the oscillation amplitude can be reduced below any given value, thus ensuring the attraction region of stationary motions of any required dimensions. In this case the control system considered can be quite acceptable for slow process stabilization in a reactor. 11 refs.; 8 figs.

36101 (INIS-SU–76, pp. 69-70) **Structural redundance of NPPs and diagnostics.** Znyshev, V.V.; Sabaev, E.F. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

A new approach to functional diagnosis of NPP state based on structural redundance, owing to which in major of the facilities there are elements identical as to the structure and operational conditions, is suggested. The difference from zero by the given value for one parameter measured for various identical elements is an indicator of a failed element and a signal for diagnostic analysis. 3 refs.

36102 (INIS-SU–76, pp. 71-76) **On some methods of NPP functional diagnostics.** Babkin, N.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

Methods for NPP functional diagnosis, in which space and time dependences for controlled variable anomalous deviations change are used as characteristic features, are suggested. The methods are oriented for operative recognition of suddenly appearing defects and envelop quite a wide range of possible anomalous effects in an onject under diagnostics. Analysis of transients dynamic properties caused by a failure is realized according to the rules, which do not depend on the character of anomalous situation development. 8 refs.; 1 fig.

36103 (INIS-SU–76, pp. 76-82) **On an approach to NPP diagnostics automation.** Babkin, N.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

A method for early detection of the reasons for suddenly appearing anomalous situations, which unites different methods of functional diagnosis, based on using systems dynamic properties, is suggested. The process of failure recognition, independently of the plant operational conditions and the character of controlled variables change is realized when characteristics features of an anomalous process are revealed by means of three efficiently interacting and complementing each other algorithms, permitting a simple program realization. 5 refs.

36104 (INIS-SU–76, pp. 82-87) **Failed element monitor for a NPP.** Znyshev, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In

Physics and technology of atomic reactors. Scientific-technical collection. Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

The problem of failed NPP element identification is interpreted as a typical one for the control theory with required trajectory realization, where possible failures are considered as desired control actions. The design principles of a device, solving the problem for the case of linear mathematical description of dynamics of NPP element controlled values when failures appear, are presented. 10 refs.

36105 (INIS-SU–76, pp. 88-89) **Automation of confidence control for the initial measured data at in-situ level of on-line control system at NPPs with RBMK reactors.** Gorobunov, V.P.; Karpan, N.V.; Saprykin, E.M.; Vorb'ev, V.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

A subsystem for an on-line control system of a NPP with RBMK type reactor, designed for queueing automated confidence control of preliminary technological data and the balances of energy and mass exchange in the reactor, is considered. The subsystem solves the following concrete problems: ascertaining of controlled process stationary character and calculation of mathematical expectation and root-mean-square deviation of controlled parameters for each stationary section; tests of primary temperature meters pressure gauges by two independent conditions, evaluation of true values of the main thermal parameters of a power unit, evaluation of summary systematic errors of the corresponding primary measurement devices, control of coolant flowmeters. 2 refs.

36106 (INIS-SU–76, pp. 90-92) **Experience in using the in-situ subsystem providing reactor operation in on-line control system of the Smolensk NPP.** Komarov, V.I.; Isaev, N.V.; Shkurkina, V.M.; Shmonin, Yu.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

The structure and operational experience for a subsystem used in and in-situ on-line control system of NPPs with RBMK type reactors, ensuring physical calculations of the reactor in the process of its operation and planning of continuous and partial refueling an other purposes, are considered. 6 refs.; 1 fig.

36107 (INIS-SU–76, pp. 96-100) **Method for calculating optimal rules of making the decisions about accidents in commercial equipment.** Kozin, I.O.; Ostrejkovskij, V.A.; Sal'nikov, N.L. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

The method suggested is applicable for the equipment, the emergency state of which is controlled by wrong parameters. The problem to be solved is formulated in the following way: how, successively observing the measured process values the problem on the moment of alarm signal begin in the case of an accident but so, that (on the one side) to avoid false alarm and (on the other side) that the time between the moments of alarm signal and the accident will be the minimum one can be solved. The optimal solution on the equipment switching-off is made by the criterion of economic loss minimization due to its realization. It is considered that alarm settings can be the decisive rules for localization of failure point. Wrong recognition of accident point results in economic expenses, which also affect the value of settings. 9 refs.

36108 (INIS-SU–85, pp. 36-43) **Methods of power distribution determination using the signals from out-of-pile detectors.** Dirkov, I.V.; Kaminskij, A.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

Taking into account peculiarities of the HTGR type reactors operating according to once-through-then-out principle methods of power density distribution control using the indices of out-of-pile detectors are considered. Methods based on using the detector response functions for single sources are discussed. It is shown that an increase in the detection energy threshold weakens considerably the sensitivity of the detector response function to the reactor parameter variations. During the detection of epithermal and fast neutrons matrix stability for energy release field reconstruction is practically ensured which increases the control efficiency and accuracy. To refine the energy release field the results of gas temperature measurements at the core outlet can be used. 15 refs.; 3 tabs.

36109 Development and application of AI technology to plant operation and support. Sackett, J.I. (Argonne National Lab., Idaho Falls, ID (USA)); Mott, J.E. *Nuclear Engineering and Design (Netherlands),* 113(2): 229-240 (Apr 1989). (CONF-870832–: Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry: present and future, Snowbird, Utah, USA, 31 Aug - 2 sep 1987).

This paper discusses a framework for the development and application of artificial intelligence (AI) technology in existing nuclear facilities and reviews the status of development. We consider those areas best addressed by AI technology, e.g., equipment diagnostics, sensor validation, and expert systems for procedural response or planning. A brief discussion of work in computer displays is also given.

2205 Environmental Aspects

Refer also to citation(s) 35767, 36015, 36163, 37380

36110 (CONF-890546–7) **Correlation of recent fission product release data.** Kress, T.S.; Lorenz, R.A.; Nakamura, T.; Osborne, M.F. Oak Ridge National Lab., TN (USA). 1989. 10p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From Seminar on fission product transport processes in reactor accidents; Dubrovnik, Yugoslavia; 22-26 May 1989. Order Number DE89012972/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

For the calculation of source terms associated with severe accidents, it is necessary to model the release of fission products from fuel as it heats and melts. Perhaps the most definitive model for fission product release is that of the FASTGRASS computer code developed at Argonne National Laboratory. There is persuasive evidence that these processes, as well as additional chemical and gas phase mass transport processes, are important in the release of fission products from fuel. Nevertheless, it has been found convenient to have simplified fission product release correlations that may not be as definitive as models like FASTGRASS but which attempt in some simple way to capture the essence of the mechanisms. One of the most widely used such correlation is called CORSOR-M which is the present fission product/aerosol release model used in the NRC Source Term Code Package. CORSOR has been criticized as having too much uncertainty in the calculated releases and as not accurately reproducing some experimental data. It is currently believed that these discrepancies between CORSOR and the more recent data have resulted because of the better time resolution of the more recent data compared to the data base that went into the CORSOR correlation. This document discusses a simple correlational model for use in connection with NUREG risk uncertainty exercises. 8 refs., 4 figs., 1 tab.

36111 (TVA/WR/AB–89/3) **Plankton studies at Sequoyah Nuclear Plant in 1988.** Dycus, D.L. Tennessee Valley Authority, Chattanooga, TN (USA). River Basin Operations/Water Resources. Mar 1989. 67p. Sponsored by Tennessee Valley Authority. Order Number DE89014509/JAW. Available from NTIS, PC A04/MF A01 - OSTI.

Previous studies have indicated Sequoyah Nuclear Plant (SQN) may have a substantial effect on plankton during periods of two unit operation combined with low river flows. Coincidental occurrence of two unit operation and more normal flows was not encountered during previous studies to determine if these effects were observed under less severe conditions. Continued plankton studies are aimed at evaluating the effect of SQN on plankton under full plant operation and river flows more commonly encountered. In August 1985, after the recommendation was made to continue plankton evaluations, both units at SQN were shut down and remained down until 1988. Unit 2 was restarted in April 1988. Unit 1 began intermittent operation late in 1988. In the absence of conditions recommended for continued study, sampling protocols were altered in 1986, 1987, and 1988. Studies conducted in 1986 and 1987 were reported previously (TVA 1988a) and sent to the Tennessee Department of Health and Environment in January 1988 in fulfillment of an agreement to provide an annual status report on the continued plankton studies. Studies conducted in 1988 are summarized herein. These studies emphasized in-plant conditions rather than reservoir conditions to determine the effect on plankton organisms passing through the plant. 3 refs., 17 tabs.

2206 Research, Test, and Experimental Reactors

Refer also to citation(s) 36000, 36011, 36035, 36081, 36097, 36148, 36167, 36724, 37098, 37099

36112 (CONF-890470– VI.B.1.1-VI.B.1.7) **Development and implementation of quality based team and diagnostic skills training at the advanced test reactor.** Peterson, L.W. (EG and G Idaho, Inc., Idaho Falls (USA)). Oak Ridge National Lab., TN (USA). Apr 1989. DOE Contract AC07-76ID01570. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The Department of Energy's (DOE) Advanced Test Reactor (ATR) has been involved in Team and Diagnostic Skills training since the early part of 1988. This training was developed in-house utilizing material from numerous sources. To assist in achieving a high quality program that would be both well received by operations and effective in bringing positive behavior changes, concepts of adult learning were utilized in the development and implementation. This paper states the concepts and discusses how they were and continue to be used to develop, revise, and implement Team and Diagnostic Skills training at ATR.

36113 (CONF-890470– VI.B.3.1-VI.B.3.10) **Developing a performance based retraining program for the advanced test reactor (ATR) reactor operators and supervisors.** Betz, T.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The Department of Energy's (DOE) Advanced Test Reactor (ATR) is operated to support DOE's requirements for fuel and material irradiation data. In addition, limited space is made available to industry for materials irradiation and radioactive isotope production. The 250 MW(th) ATR was designed in the early 1960's, constructed in the mid 1960's and placed in operation in 1967. It has operated successfully for the past 22 years. Several improvements were made to the initial training and retraining programs after the Three Mile Island (TMI) accident to make them comply with DOE Order 5480.6 section 8e, Reactor Personnel Training and Qualification Program. This paper discusses these activities. In formulating the Performance Based Retraining program for ATR reactor operators and supervisors, industry experience, INPO Guidelines, DOE requirements, ANS 3.1, and the experience of 22 years of ATR operation/training were considered. This approach to retraining is consistent with INPO Guidelines and Good Practices, and DOE requirements. This paper addresses the following key elements in the development and implementation of a performance based retraining program: (1) selection of retraining items utilizing task analysis; (2) features of the program; (3) program evaluation; and (4) lessons learned after two years of conduct.

36114 (EGG-M–88332) **Plant life extension program for the Advanced Test Reactor.** Croucher, D.W.; Zeile, H.J. Idaho National Engineering Lab., Idaho Falls, ID (USA). 1989. 5p. Sponsored by DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-890721–17: Joint ASME/JSME pressure vessel and piping conference, Honolulu, Hawaii, USA, 23-27 Jul 1989). Order Number DE89009734/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

The 250 MW_t Advanced Test Reactor (ATR) is a Department of Energy (DOE) facility that has operated successfully for the past 20 years at the Idaho National Engineering Laboratory (INEL) to support DOE's requirements for fuel and material irradiation data. The ATR also produces irradiated material and radioactive isotopes for industry. DOE anticipates that this facility will be needed well beyond the year 2014. To extend the safe operation life of the ATR and maximize its usefulness, researchers at the INEL are implementing an integrated program of (a) system and component aging evaluation, (b) design and safety documentation evaluation against regulatory requirements, and (c) probabilistic risk assessment. It is intended that the ATR Plant Life Extension activities fit within the regulatory framework being developed for utilities by the Nuclear Regulatory Commission. 12 refs., 1 fig., 2 tabs.

36115 (IAEA-R–3512-F) **Calculation analysis of TRIGA MARK II reactor core composed of two types of fuel elements. Final report for the period 1 August 1984 - 31 July 1986.** Ravnik, M. Institut Jozef Stefan, Ljubljana (Yugoslavia); International Atomic Energy Agency, Vienna (Austria). Nov 1988. 103p. (IJS-DP–5041). Order Number DE89618248/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI;INIS.

The most important properties of mixed cores are treated for TRIGA MARK II reactor, composed of standard (20% enriched, 8.5w% U content) and FLIP (70% enriched, 8.5w% U content) fuel elements. Large difference in enrichment and presence of burnable poison in FLIP fuel have strong influence on the main core characteristics, such as: fuel temperature coefficient, power defect, Xe and Sm worth, power and flux distributions, etc. They are significantly different for both types of fuel. Optimal loading of mixed cores therefore strongly depends on the loading pattern of both types of fuel elements. Results of systematic calculational analysis of mixed cores are presented. Calculations on the level of fuel element are performed with WIMSD-4 computer code with extended cross-section library. Core calculations are performed with TRIGAP two-group 1-D diffusion code. Results are compared to measurements and physical explanation is provided. Special concern is devoted to realistic mixed cores, for which optimal in-core fuel management is derived. Refs, figs and tabs.

36116 (INIS-mf–11446) **Symposium on HIFAR - construction and initial operation.** Australian Nuclear Association, Sutherland (Australia). 1988. 88p. (CONF-8803221–: Symposium on HIFAR - construction and initial operation, Lucas Heights, Australia, 11 Mar 1988). Order Number DE89620265/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Co-sponsored by the Australian Institute of Nuclear Science and Engineering and the Lucas Heights Scientific Society.

The construction of the HIFAR reactor at Lucas Heights and its early operational history is the subject of these papers which were presented at a symposium to mark the 30th year of HIFAR operation.

36117 (INIS-mf–11446, pp. 12) **HIFAR - project organization design and procurement.** Carr, F.H. Australian Nuclear Association, Sutherland (Australia). 1988. (CONF-8803221–: Symposium on HIFAR - construction and initial operation, Lucas Heights, Australia, 11 Mar 1988). In *Symposium on HIFAR - construction and initial operation.* Order Number DE89620265/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Co-sponsored by the Australian Institute Nuclear Science and Engineering and the Lucas Heights Scientific Society.

The HIFAR reactor and its associated buildings were constructed in a period of two years and seven months, from the date of placing the order in the United Kingdom on the 27 June 1955, to when the reactor was made critical on 26 January 1958. The reactor has operated very satisfactorily in the subsequent thirty year period with its major components intact, and no doubt will continue its safe operation for a number of years to come. The construction of HIFAR was an engineering project undertaken by staff of the AAEC in cooperation with the United Kingdom Atomic Energy Authority (UKAEA). This paper describes the contractual procedures adopted for the supply of the reactor and its assembly; and the involvement of the UKAEA, the main contractor Head Wrightson Processes Ltd., and the staff of the AAEC in the design and procurement of the components for the reactor in the UK.

36118 (INIS-mf–11446, pp. 11) **HIFAR : aspects of construction - United Kingdom and Australia.** Cooke, K.J. Australian Nuclear Association, Sutherland (Australia). 1988. (CONF-8803221–: Symposium on HIFAR - construction and initial operation, Lucas Heights, Australia, 11 Mar 1988). In *Symposium on HIFAR - construction and initial operation.* Order Number DE89620265/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Co-sponsored by the Australian Institute Nuclear Science and Engineering and the Lucas Heights Scientific Society.

This paper discusses aspects of the project management organisation for the construction of the HIFAR research reactor at Lucas Heights. The project was executed from initial contract letting to reactor criticality in less than three years.

36119 (INIS-mf–11446, pp. 17) **Some aspects of HIFAR design.** Carlson, R.W.S. (Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia)); Ebeling, D.R. Australian Nuclear Association, Sutherland (Australia). 1988. (CONF-8803221–: Symposium on HIFAR - construction and initial operation, Lucas Heights, Australia, 11 Mar 1988). In *Symposium on HIFAR - construction and initial operation.* Order Number DE89620265/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Co-sponsored by the Australian Institute Nuclear Science and Engineering and the Lucas Heights Scientific Society.

Some aspects of the HIFAR design and reasons for departing in a few areas from the original DIDO design are described. The HIFAR reactor was able to take advantage of the early operation of DIDO to incorporate some changes before construction had advanced too far.

36120 (INIS-mf–11446, pp. 4) **Instrumentation and control aspects of HIFAR.** Parry, J. Australian Nuclear Association, Sutherland (Australia). 1988. (CONF-8803221–: Symposium on HIFAR - construction and initial operation, Lucas Heights, Australia, 11 Mar 1988). In *Symposium on HIFAR - construction and initial operation.* Order Number DE89620265/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Co-sponsored by the Australian Institute Nuclear Science and Engineering and the Lucas Heights Scientific Society.

It is not possible in a brief review to describe the instrument configuration of HIFAR in detail. The purpose of these notes and the associated discussion is to give some of the historical background to the construction project, to indicate modifications necessary for early low power operation and to offer some comments on the design philosophies of the times.

36121 (INIS-mf–11446, pp. 7) **HIFAR commissioning and operation 1955-1962.** Tingate, G.A. Australian Nuclear Association, Sutherland (Australia). 1988. (CONF-8803221–: Symposium on HIFAR - construction and initial operation, Lucas Heights, Australia, 11 Mar 1988). In *Symposium on HIFAR - construction and initial operation.* Order Number DE89620265/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Co-sponsored by the Australian Institute Nuclear Science and Engineering and the Lucas Heights Scientific Society.

The Commissioning and criticality of the HIFAR research reactor at Lucas Heights is described. The calibration of HIFAR and early irradiation rigs loaded into HIFAR are also detailed.

36122 (INIS-mf–11446, pp. 14) **Current HIFAR operations.** Parsons, N.A. (Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia)). Australian Nuclear Association, Sutherland (Australia). 1988. (CONF-8803221–: Symposium on HIFAR - construction and initial operation, Lucas Heights, Australia, 11 Mar 1988). In *Symposium on HIFAR - construction and initial operation.* Order Number DE89620265/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Co-sponsored by the Australian Institute Nuclear Science and Engineering and the Lucas Heights Scientific Society.

The ANSTO plan of December 1987 defines the corporate environment of HIFAR. Amongst other things, the plan emphasised HIFAR as a key national facility, and identified HIFAR operations and facility upgrading as activities within an outward looking nuclear technology program. This paper outlines the present operation of HIFAR within that program.

36123 (NSB-QRM–1) **First quarterly report of the Nuclear Safety Bureau for the period 19 October 1987 to 18 January 1988.** Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). Nuclear Safety Bureau. Jan 1988. 9p. Order Number DE89618249/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Section 25 of the Australian Nuclear Science and Technology Organisation (ANSTO) Act 1987 requires the Board of ANSTO to appoint a Nuclear Safety Bureau which is responsible for monitoring and reviewing the safety of any nuclear plant operated by ANSTO. This first report covers the revision of the authorisation for operation of the HIFAR reactor at Lucas Heights. It reports that there were 8 unusual operating events in the three month period ending 31 December 1987, none of which were categorised as abnormal occurrences. Reports are presented dealing with maintenance, periodic inspection and testing, the HIFAR emergency control room, the HIFAR polar crane, seismic resistance of HIFAR, replacement of the HIFAR electrical power supply system, the reactor MOATA and nuclear safety aspects of reactor fuel storage.

36124 (NSB-QRM–2) **Second quarterly report of the Nuclear Safety Bureau for the period 19 January 1988 to 18 April 1988.** Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). Nuclear Safety Bureau. Apr 1988. 5p. Order Number DE89618250/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The Nuclear Safety Bureau is responsible for monitoring and reviewing the safety of any nuclear plant operated by the Australian Nuclear Science and Technology Organisation (ANSTO). The report covers operation of the HIFAR and MOATA reactors at Lucas Heights, including unusual operating events, maintenance, periodic testing, inspection, HIFAR safety documentation, shift staffing, audit of HIFAR staff training and the emergency control room, HIFAR modifications, nuclear safety aspects of reactor fuel storage and the subcritical assembly.

36125 (ORNL/TM–11188) **Bulk Shielding Facility quarterly report, January, February, and March 1989.** Laughlin, D.L.; Hamrick, T.P. Oak Ridge National Lab., TN (USA). May 1989. 15p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE89013757/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document discusses activities at the Bulk Shielding Facility during this reporting period. The Bulk Shielding Reactor (BSR) remained shut down during January, February, and March. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory. The Pool Critical Assembly (PCA) is shut down for shim-safety rod magnets and associated electronic components upgrading.

2207 Plutonium and Isotope Production Reactors

Refer also to citation(s) 36006

36126 (DP-MS–88-143-Rev.1) **Life extension approach to the reactor vessel of a nuclear production reactor: Revision 1.** Sindelar, R.L.; Awadalla, N.G.; Baumann, N.P.; Mehta, H.S. Savannah River Lab., Aiken, SC (USA). 1989. 25p. Sponsored by DOE

Nuclear Energy. DOE Contract AC09-76SR00001. (CONF-890721–10-Rev.1: Joint ASME/JSME pressure vessel and piping conference, Honolulu, Hawaii, USA, 23-27 Jul 1989). Order Number DE89008305/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

The nuclear materials production reactors at the Savannah River Plant have been in service for over 35 years. All the primary components of the reactor system are readily accessible for repair or replacement as needed except for the reactor vessel and thermal shields. The reactor vessel of a Savannah River Plant reactor is a cylindrical tank approximately 16 feet in diameter and 14 feet high and is not pressurized except for a 5 psig helium blanket gas in addition to the hydrostatic head of the heavy water (D_2O) moderator. The vessels are made of American Iron and Steel Institute Type 304 stainless steel fabricated into cylindrical shells with four to six wrought plates per vessel, 1.27 cm (0.5-inches) thick. The shells were made up in flat in two half-sections for later rolling and welding. The vessel bottom section containing the moderator effluent nozzles was welded to the shell in a T-joint configuration. All joining was performed with multipass Metal Inert Gas (MIG) welding. The service life assessment of the reactor vessel addresses the corrosive effects of the D_2O moderator and the degradation of the vessel material properties through exposure of the vessel to neutron irradiation. Potential degradation mechanisms include radiation embrittlement, Intergranular Stress Corrosion Cracking; and Irradiation-Assisted Stress Corrosion Cracking. 15 refs., 11 figs.

36127 (INIS-SU–85, pp. 33-35) **Optimization of the spectrum for target irradiation.** Zaritskaya, T.S.; Kiselev, G.V.; Rudik, A.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

Solution of the problem on neutron spectrum optimization in the point where a target is located in an isotope production reactor is considered. The case when the spectrum does not change in the process of irradiation is studied. It is shown that the algorithm of the optimal process general theory with parameters can be used for the problem solution. 5 refs.; 1 fig.

2208 Propulsion Reactors

36128 (BNL–41450) **Small propulsion reactor design based on particle bed reactor concept.** Ludewig, H.; Lazareth, O.; Mughabghab, S.; Perkins, K.; Powell, J.R. Brookhaven National Lab., Upton, NY (USA). 1989. 15p. Sponsored by Department of Defense. DOE Contract AC02-76CH00016. (CONF-890103–11: 6. symposium on space nuclear power systems, Albuquerque, New Mexico, USA, 9-12 Jan 1989). Order Number DE89013569/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper Particle Bed Reactor (PBR) designs are discussed which use ^{233}U and ^{242m}Am as fissile materials. A constant total power of 100MW is assumed for all reactors in this study. Three broad aspects of these reactors is discussed. First, possible reactor designs are developed, second physics calculations are outlined and discussed and third mass estimates of the various candidates reactors are made. It is concluded that reactors with a specific mass of 1 kg/MW can be envisioned of ^{233}U is used and approximately a quarter of this value can be achieved if ^{242m}Am is used. If this power level is increased by increasing the power density lower specific mass values are achievable. The limit will be determined by uncertainties in the thermal-hydraulic analysis. 5 refs., 5 figs., 6 tabs.

2209 Reactor Safety

Refer also to citation(s) 35785, 35786, 35825, 35826, 35830, 35831, 35841, 35990, 36035, 36048, 36050, 36053, 36091, 36094, 36095, 36110, 36114, 37380, 37411, 37757

36129 (BNL-NUREG–42727) **Development of alternate visual examination requirements for dynamic restraints (snubbers).** Reich, M.; Breidenbach, G.; Grossman, W. Brookhaven National Lab., Upton, NY (USA). 1989. 7p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (CONF-890721–35: Joint ASME/JSME pressure vessel and piping conference, Honolulu, HI, USA, 23-27 Jul 1989). Order Number DE89014711/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Current plant technical specifications require an initial inservice visual examination of safety related equipment dynamic restraints (snubbers) to provide assurance of operability. The time to the next examination is as short as 1 month if 8 or more snubbers are found to be inoperable. Plant operators have observed that as the snubber population of a plant increases, the current plan becomes burdensome by requiring frequent shutdowns for examination of snubbers. The Nuclear Regulatory Commission (NRC) has recognized the need and has sponsored a program to develop alternate visual examination criteria which would require examinations at constant intervals such as at refueling outages. Brookhaven National Laboratories (BNL) was selected by the NRC to conduct this program. Based on the review and evaluation of the information gathered to date, and the conclusions drawn from plant visits and the Snubber Utility Group (SNUG) data base, BNL has developed an alternate statistically-based plan which provides the permissible number of inoperable snubbers for constant and twice constant visual examination intervals for various snubber population groups. 3 refs., 2 figs., 2 tabs.

36130 (CEA-DAS–539e) **International co-operation in the field of operational safety.** Dupuis, M.C. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete. Oct 1988. 11p. (CONF-881014–: International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety, Avignon, France, 2-7 Oct 1988). Order Number DE89776470/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Operational safety in nuclear power plants is without doubt a field where international co-operation is in constant progress. Accounting for over 80 per cent of the 400 reactors in service throughout the world, the menber countries of the OECD Nuclear Energy Agency (NEA) are constantly striving to improve the exchange and use of the wealth of information to be gained not just from power plant accidents and incidents but from the routine operation of these facilities. The Committee on the Safety of Nuclear Installations (CSNI) helps the Steering Committee for Nuclear Energy to meet the NEA's objectives in the safety field, namely: - to promote co-operation between the safety bodies of member countries - to contribute to the safety and regulation of nuclear activities. The CSNI relies on the technical back-up of several different working groups made up of experts appointed by the member countries. For the past three years I have had the honour of chairing Principal Working Group 1 (PWG 1), which deals with operating experience and human factor. It is in this capacity that I will attempt to outline the group's various activities and its findings illustrated by a few examples.

36131 (CEA-DAS–562) **Some aspects of the research and development programmes on the behaviour of containments during severe accidents.** Dufresne, J. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete. Jan 1989. 12p. (CONF-8810375–: Reunion de l'AIEA sur le comportement ultime des enceintes, Moscou, USSR, 17-21 Oct 1988). Order Number DE89776469/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The R and D programmes relating to the behaviour of containments during severe accidents cover several domains: .leaktightness of the containment: this programme concerns the mechanical resistance of the concretes and the cracking criteria, on the one hand, and the leak rate through the porosities or cracks, on the other; . gaseous releases inside the containment. In addition to the releases of steam and fission products from the primary circuit, the gaseous H_20 and $C0_2$ releases from the concrete must also be studied: firstly during the corium-concrete interaction, and secondly during the heating of the internal surface of the containment which can be raised to a high temperature on contact with the atmosphere, for example during hydrogen combustion; . the release of fission products during the corium-concrete interactions; . the behaviour of the fission products inside the containment, particularly as regards iodine.

36132 (CNEN-DR-GAPS-RA–01/88) **Use of source term code package in the ELEBRA MX-850 system.** Guimaraes, A.C.F.; Goes, A.G.A. Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dec 1988. 110p. (In Portuguese). Order Number DE89620445/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The implantation of source term code package in the ELEBRA-MX850 system is presented. The source term is formed when radioactive materials generated in nuclear fuel leakage toward containment and the external environment to reactor containment. The implantated version in the ELEBRA system are composed of five codes: MARCH 3, TRAPMELT 3, THCCA, VANESA and NAVA. The original example case was used. The example consists of a small loca accident in a PWR type reactor. A sensitivity study for the TRAPMELT 3 code was carried out, modifying the 'TIME STEP' to estimate the processing time of CPU for executing the original example case. (M.C.K.).

36133 (CONF-890470– II.A.1.1-II.A.1.11) **Research in operations: operator reliability experiments.** Worledge, D.H. (Electric Power Research Institute, Palo Alto, CA (USA)); Joksimovich, V.; Spurgin, A.J. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The purpose of the EPRI Operator Reliability Experiments (ORE) Project is to collect data for use in reliability and safety studies of nuclear power plant operation which realistically take credit for operator performance in preventing core damage. Three objectives of this work are: (1) to develop a data collection and analysis procedure; (2) to obtain quantitative and qualitative data on operating crew performance in the control room for potential accident sequences using plant simulators; and (3) to test the Human Cognitive Reliability (HCR) correlation.

36134 (CONF-890470– II.A.2.1-II.A.2.18) **Research in operations: lessons learned.** Molden, J.E. (Pacific Gas and Electric, CA (USA)). Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Over the past several years, increased attention has been focused on control room resource management. Although the need has arisen from a variety of circumstances, the mission has always been clear. The industry must both pursue new methods and continue with existing approaches which will provide measurable improvements in the control room team performance. A key factor in succeeding is the ability to quantify acceptable performance. Once this is achieved, changes needed to make improvements will be better understood. The purpose of this paper is to discuss an Electric Power Research Institute (EPRI) project that Diable Canyon has been involved in which has already resulted in improved team performance.

36135 (CONF-890470– III.B.5.1-III.B.5.6) **Developing a systematic approach to team training for emergency response personnel.** Derrer, Y.E. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Preparing a group of station employees with diverse expertise and backgrounds to work together as a team during an emergency is a challenge. One that is best addressed by a systematic approach to team training. To provide more effective training the Washington Public Power Supply System's Technical Training Department conducted a job and task analysis. Based on the results the Supply System redeveloped initial training, using a center based concept. This system provided a method to train individuals from different disciplines as a team. To avoid simple repetition of initial concepts and to culture the team approach, a center based continuing training program was developed which focused on the previous year's major exercise scenario. This system allowed all center members the opportunity to interact with each other as a team, learn from any deficiencies identified during the previous year and provide input to enhance center operations. This systematic approach has been accepted by the participants with a positive attitude, has led to closer teamwork and has reduced the number of deficiency findings.

36136 (CONF-890470– IV.A.2.1-IV.A.2.13) **Changing organizational cultures - creating quality achievers through training and teamwork.** Widen, W.C.; Cowell, T.H. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

The author notes several examples of disastrous and near-disastrous occurrences within the chemical, aviation, and nuclear industries to illustrate his discussion of the following topics: man-machine interface: the growing battle of automation complacency; creating quality achievers: a complex issue of changing organizational cultures; creating organizational change through training and teamwork; enhancing professionalism through training: the conduct of operations program; and lessons learned. Specific communications recommendations are given.

36137 (CONF-890470– IV.A.5.1-IV.A.5.18) **Systematic problem solving process (SPSP) - root cause analysis that works.** Kubenka, J.H. (Houston Lighting and Power, TX (USA)). Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

In January, 1988, the South Texas Project Nuclear Training Department began to research a methodology for root cause analysis in response to a Nuclear Safety Review Board (NSRB) request. As a result, the Systematic Problem Solving Process (SPSP) was developed to provide a simple methodology which encompasses all elements needed to perform a competent and thorough problem analysis and to project valid solutions to those problems. The SPSP assumes that errors which result in undesirable events (problems) will be made in a sequence of actions during some work activity. It assumes that the errors will be made by very capable, carefully selected, trained and qualified people who are strongly biased against making errors that have undesirable or dangerous effects. The process also assumes that the organizational system is at fault more often than the individual and tries to find out how the system failed the individual rather than how the individual failed the system. The SPSP training course describes and provides practical exercises in the thought processes and techniques used by experienced accident and incident investigators. The course provides a potential investigator with a tool box which contains all the necessary tools to deal with problems both simple and complex. The course also provides instruction on how to use each of the tools individually and in conjunction with each other to effect reasonable solutions to problems encountered. The techniques are specifically applicable to the nuclear power plant environment and its organization.

36138 (CONF-890470– IV.B.1.1-IV.B.1.8) **Personnel development program (an enhancement to GET).** Patrilla, V. (Iowa Electric Light and Power Co., Cedar Rapids (USA)); Holden, W.A. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Cooperation, common sense, and training together helped lower the error rate at the Duane Arnold Energy Center. One training activity, procedural awareness training, has been made a badging requirement. Its use is correlated with a significantly reduced rate of certain errors. Iowa Electric Light and Power believes the effectiveness of this class is based on its continually evolving content. The content of the class is defined by the plant supervisors and current site or industry concerns.

36139 (CONF-890470– IV.B.3.1-IV.B.3.16) **Annual critique: an effective program evaluation tool.** Wall, T.J.; McKenzie, L.J. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium

on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

Accreditation by the Institute of Nuclear Power Operations (INPO), indicates a Utility has made a formal commitment to a systematic approach to training. Duke Power Company had implemented INPOs Training System Development (TSD) model to achieve accreditation of its programs in 1986. The last phase of the five step model includes a systematic evaluation of the effectiveness of the training program. This evaluation relies on data collected from the client group, and the training group's ability to respond and affect needed changes to the training program. This paper will discuss using an annual critique to accomplish specialization of on-the-job (OJT) training requirements for the Health Physics discipline at Duke Power Company. The discussion details the feedback process that lead to specialization, the process involved to get changes made, and the cost savings and results of implementing these changes. The paper also addresses the client-training group relationship that created the ability to make this happen.

36140 (CONF-890470– V.B.3.1-V.B.3.29) **Role of environmental qualification training in nuclear plant maintenance.** Krantz, G.W. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

For the next two and one-half decades, the operation of the 111 completed and the nearly completed or near-term operating license (NTOL) plants will predominate. Already, however, there is a rush on extension of life, Nuplex (Nuclear Plant life Extension), of their newly operational plants. Since nuclear safety is paramount, however, they can neither dismiss nor omit the need for the very highest caliber maintenance on that segment of their nuclear plants involved in shutting down the plant and in maintaining safe shutdown in the case of a serious design basis accident. Although the redundant, safety-related, shutdown equipment receives no fanfare for megawatts generated or revenue produced, the equipment must receive the limelight of attention in the ongoing maintenance program throughout the life of the plant. The equipment is required by the NRC to receive special attention from design, through manufacturing, procurement, storage, installation, operation, testing and most importantly - maintenance. This paper deals with the required installation of this equipment in harsh plant environments, the importance placed on maintenance of the equipment, and of the role of training in the maintenance activities.

36141 (CONF-890470– V.B.5.1-V.B.5.12) **Radiation monitoring training system - an aid to performance-based training.** Boudreaux, C.L. Oak Ridge National Lab., TN (USA). Apr 1989. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, USA; 23-27 Apr 1989. In *Proceedings of the eight symposium on training of nuclear facility personnel.* Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01.

This paper covers the use of Waterford-3 plant-specific equipment used for hands-on training of plant personnel. Specifically, the Radiation Monitoring Training System is discussed; however, the application applies to any component or system utilized to support a performance-based training program.

36142 (CONF-890721–31) **A method for three-dimensional structural analysis of reinforced concrete containment.** Kulak, R.F.; Fiala, C. Argonne National Lab., IL (USA). 1989. 10p. Sponsored by DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Joint ASME/JSME pressure vessel and piping conference; Honolulu, Hawaii, USA; 23-27 Jul 1989. Order Number DE89013306/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A finite element method designed to assist reactor safety analysts in the three-dimensional numerical simulation of reinforced concrete containments to normal and off-normal mechanical loadings is presented. The development of a lined reinforced concrete plate element is described in detail, and the implementation of an empirical transverse shear failure criteria is discussed. The method is applied to the analysis of a 1/6th scale reinforced concrete containment model subjected to static internal pressurization. 11 refs., 14 figs., 1 tab.

36143 (CONF-890721–32) **Comparison of analysis and vibration test results for a multiple supported piping system.** Hsieh, B.J.; Kot, C.A.; Srinivasan, M.G. Argonne National Lab., IL (USA). 1989. 38p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-31109-ENG-38. From Joint ASME/JSME pressure vessel and piping conference; Honolulu, Hawaii, USA; 23-27 Jul 1989. Order Number DE89013191/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The behavior of a nuclear power plant piping system subjected to high level vibrational excitation is investigated experimentally and analytically. The objective is to evaluate the piping analysis method employed in the SMACS computer code. Experimental data are obtained from the Large Shaker Experiments (SHAG) conducted at the HDR Test Facility in Kahl/Main, FRG, in which the dynamic behavior of an in-plant piping system with various support configurations was investigated. Comparisons of calculational results with measured data indicate that the adequacy of the prediction depends primarily on the modeling of boundary conditions and dynamic supports. Treating the latter as rigid and using building motion as input, in general, results in under prediction of piping response. On the other hand when accelerations on the pipe side of the dynamic support attachment are used as input, piping response is highly overpredicted. Also modeling wall/floor component attachments as fixed usually leads to underprediction of amplitude as well as differences in the frequency content of response. 9 refs., 18 figs., 1 tab.

36144 (EGG-M–88406) **Results of the initial phase of the INEL/USNRC large bore hydraulic snubber reliability evaluation program.** Ware, A.G.; Nitzel, M.E.; Rahl, T.E.; Edson, J.L.; Page, J.D. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 10p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (CONF-890721–28: Joint ASME/JSME pressure vessel and piping conference, Honolulu, Hawaii, USA, 23-27 Jul 1989). Order Number DE89011131/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

The reliability of large bore hydraulic snubbers (LBHSs) is a present safety concern in nuclear power plants. LBHSs are used primarily to restrain large components such as steam generators and reactor coolant pumps during seismic events. Initially there were no test machines capable of testing LBHSs for functionality, so they were exempted from surveillance testing prior to 1980. When LBHSs were later tested, numerous deficiencies, many of which would render the LBHSs inoperable, were found. This paper describes the initial phase of the INEL/USNRC LBHS research program whose objective is to assess the need to improve the reliability of LBHSs and to determine what, if any, requirements should be implemented to achieve necessary improvements. The program has assessed the current state of LBHSs, including types and locations of snubbers in plants, operational and maintenance requirements, current in-service inspection tests, and the availability of state-of-the-art testing equipment. Operating experience data, including information contained in the Nuclear Plant Reliability Data System and Licensee Event Reports, have been summarized to determine the modes of snubber failure. 15 refs., 11 figs., 1 tab.

36145 (GAO/NSIAD–88-131BR) **Nuclear power safety.** General Accounting Office, Washington, DC (USA). National Security and International Affairs Div. 1988. 38p. Available from General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

The International Atomic Energy Agency, the organization concerned with worldwide nuclear safety has produced two international conventions to provide (1) prompt notification of nuclear accidents and (2) procedures to facilitate mutual assistance during an emergency. IAEA has also expanded operational safety review team missions, enhanced information exchange on operational safety events at nuclear power plants, and planned a review of its nuclear safety standards to ensure that they include the lessons learned from the Chernobyl nuclear plant accident. However, there appears to be a nearly unanimous belief among IAEA members that may attempt to impose international safety standards verified by an international inspection program would infringe on national sovereignty. Although several Western European countries have proposed establishing binding safety standards and inspections, no

specific plant have been made; IAEA's member states are unlikely to adopt such standards and an inspection program.

36146 (GAO/RCED-88-73) **Nuclear regulation.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1988. 40p. Available from General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

In December 1986, a pipe rupture at Virginia Electric and Power Company's Surry Unit 2 nuclear power plant injured eight workers; four subsequently died. In July 1987, widespread pipe deterioration was discovered at General Electric's Trojan plant in Oregon. These events raise questions about the long-term safety of pipe systems in nuclear power plants. The Nuclear Regulatory Commision has now required utilities to provide information on the extend of known pipe deterioration at each plant. As of January 1988, NRC staff identified 34 new and mature plants with erosion/corrosion damage. It expects to gather additional information and use it to determine whether specific regulatory action is needed. In addition, a utility industry group has developed a program to help companies detect and repair pipe damage.

36147 (IAEA-TECDOC-503) **Reviewing surveillance activities in nuclear power plants. Supplementary guidance and reference material for IAEA Operational Safety Review Teams (OSARTs).** International Atomic Energy Agency, Vienna (Austria). Mar 1989. 143p. Order Number DE89620240/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

This document provides guidance to Operational Safety Review Teams (OSARTs) for reviewing surveillance activities at a nuclear power plant. In addition, the document contains reference material to support the review of surveillance activities, to assist within the Technical Support area and to ensure consistency between individual reviews. Drafts of the document have already been used on several OSART missions and found to be useful. The document first considers the objectives of an excellent surveillance programme. Investigations to determine the quality of the surveillance programme are then discussed. The attributes of an excellent surveillance programme are listed. Advice follows on how to phrase questions so as to obtain an informative response on surveillance features. Finally, specific equipment is mentioned that should be considered when reviewing functional tests. Four annexes provide examples drawn from operating nuclear power plants. They were selected to supplement the main text of the document with the best international practices as found in OSART reviews. They should in no way limit the acceptance and development of alternative approaches that lead to equivalent or better results. Refs, figs and tabs.

36148 (INIS-mf-11446, pp. 13) **HIFAR refurbishing program.** Allen, M.R. (Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia)). Australian Nuclear Association, Sutherland (Australia). 1988. (CONF-8803221-: Symposium on HIFAR - construction and initial operation, Lucas Heights, Australia, 11 Mar 1988). In *Symposium on HIFAR - construction and initial operation.* Order Number DE89620265/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Co-sponsored by the Australian Institute Nuclear Science and Engineering and the Lucas Heights Scientific Society.

The refurbishing program was originally planned in 1982 to cover a five year period and in view of the limited development of the proposals at this date the progress has been satisfactory. The inclusion of the Cooling Towers and Data Acquisition System in the program has had the effect of extending the required funding and timescale of the program. The investigations of reactor systems which are important to safety have shown that HIFAR does not have significant deficiencies with respect to the basic plant design features with the possible exception of the Electrical Power Supply System and seismic resistance. The radiological consequences of rare event reactor accidents resulting from in-plant causes have been examined for the existing plant and found to be well within the limits of the safety criteria. However, the reactor does contain old equipment in safety related plant and an on-going program of plant monitoring and replacement is essential if HIFAR is to maintain the current safety status, although at a lower level of activity than is current for this refurbishing program.

36149 (INIS-mf-11940) **Reactor safety research results and perspectives.** Banaschik, M. Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.). 1988. 14p. (In German). (CONF-881131-: Society for Reactor Safety meeting on research to increase the safety of nuclear power plants, Cologne, Germany, F.R., 3-4 Nov 1988). Order Number DE89788197/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The reactor safety research activities cover many and extensive experiments and the development of theoretical models for verification of the design requirements. The results achieved so far bring in significant information on the safety margins of nuclear installations and their systems, and on potential enhancements of engineered safety. Further activities and developments will be directed towards the design-exceeding incident scenarios, in order to find out appropriate preventive measures and techniques, based on the safety potentials inherent in the conservative design of the operating and safety systems. The R and D activities are intended to yield accident management tools capable of bringing back a plant to safe operating conditions even after a severe accident. This is to be achieved by exploiting the safety margins and using also the operating systems for accident management. Hence the R and D work investigates operating processes and plant-specific conditions. There is a good exchange of experience and knowledge in this field on an international level, due to the great public interest in best possible safety of the peaceful utilization of nuclear energy in any country of the world.

36150 (INIS-mf-11941) **Perspectives of expert systems for nuclear reactor safety.** Bastl, W. Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.). 1988. 19p. (In German). (CONF-881131-: Society for Reactor Safety meeting on research to increase the safety of nuclear power plants, Cologne, Germany, F.R., 3-4 Nov 1988). Order Number DE89788198/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

There is a wide range of possible expert system applications in the field of nuclear reactor safety: - in the safety-oriented design review of reactor systems, here particularly for subsequent modifications indicated by operating experience; - for safety analyses, (nuclear plant analyser, fault free analysis); - for operational safety engineering including accident management (diagnostic systems); - for maintenance and training purposes. The potentials of expert systems are based on the following factors: storage of information in the knowledge base, efficient use of extensive data bases, intensive interactive mode operation, rapid development of prototypes.

36151 (INIS-mf-11942) **Large-scale experiments and their significance for development and verification of thermal hydraulics computer codes.** Wolfert, K.; Riegel, B.; Sonnenburg, H.G. Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.). 1988. 27p. (In German). (CONF-881131-: Society for Reactor Safety meeting on research to increase the safety of nuclear power plants, Cologne, Germany, F.R., 3-4 Nov 1988). Order Number DE89788199/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Large scale experiments cover single-effect experiments in a 1:1 scale reactor component mockup facility, and integral experiments in a mockup of the primary and secondary circuit. The single-effect experiments form the basis of a purposeful development and verification of models describing larger range process phenomena to be expected in operation of reactor installations, and integral experiments allow a verification of the interaction of the various single models. The systematic testing procedure set up for development and verification yields a realistic description of the physical phenomena occurring in a reactor facility and allows extensive and comprehensive verification of the entire programme.

36152 (INIS-mf-11943) **ATHLET - an advanced system code for the analysis of thermohydraulic processes.** Teschendorff, V.; Miro, J.; Lerchl, G. Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.). 1988. 19p. (In German). (CONF-881131-: Society for Reactor Safety meeting on research to increase the safety of nuclear power plants, Cologne, Germany, F.R., 3-4 Nov 1988). Order Number DE89788200/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The ATHLET computer code is being developed by GRS in order to be able to treat and model LOCA and transient conditions in a

PWR or BWR with just one computer code instead of the hitherto three codes available that are written for different applications. The tasks to be performed cover description of design-exceeding accidents and core meltdown accidents, which are to be calculated and simulated as realistic as possible in order to avoid errors and faulty assessments. For modelling of accidents with core disruption, a code ATHLET-SA ist being developed in cooperation with the IKE. This version also includes models of core meltdown and fission product behaviour. The ATHLET code is intended as a code with uniform program structure covering various models differing in detail treatment. Data input is user friendly and allows visual checking of program input for the plant geometry data by means of a graphic display.

36153 (INIS-mf–11944) **Nuclear plant analyser, a tool for evaluating actions of accident management.** Beraha, D.; Lerchl, G.; Voggenberger, T. Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.). 1988. 21p. (In German). (CONF-881131–: Society for Reactor Safety meeting on research to increase the safety of nuclear power plants, Cologne, Germany, F.R., 3-4 Nov 1988). Order Number DE89788201/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The nuclear plant analyser currently developed by GRS and Siemens/KWU allows to use detailed models as well as fast and simple models. The thermofluid codes TRAC and ATHLET are used as process models. Both codes are capable of modelling the effects of accident management actions on the course of events on the 'prevention' level. An extension to the 'mitigation' level is possible by combination with the ATHLET-SA version. The analyser allows extensive simulation of thermohydraulic stand by systems and monitoring and safety systems of a plant in order to obtain a realistic verification of preventive actions and their effects by a description of plant behaviour as exact as possible.

36154 (INIS-SU–85, pp. 74-78) **Method for calculating hydrogen propagation accidents in NPP compartments under accidents.** Budaev, M.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki 231Fizika i metody rascheta yadernykh reaktorov.; no. 2.

A mathematical model and the PROBL-2 the computer code are described, which allows to calculate parameters of containment atmosphere during accidents with respect to hydrogen propagation. 8 refs.; 2 figs.

36155 (INIS-XN–182) **Nuclear Accidents Intervention Levels for Protection of the Public.** Nuclear Energy Agency, 75 - Paris (France). 1989. 97p. Order Number DE89619908/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

The impact of the 1986 Chernobyl accident called attention to the need to improve international harmonization of the principles and criteria for the protection of the public in the event of a nuclear accident. This report provides observations and guidance related to the harmonization of radiological protection criteria, and is intended to be of use to national authorities and international organizations examining the issue of emergency response planning and intervention levels.

36156 (JAERI-M–88-271) **Break location effects on PWR small break LOCA phenomena. Inadequate core cooling in lower plenum break test at LSTF.** Suzuki, Mitsuhiro. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1989. 208p. Order Number DE89790899/JAW. Available from NTIS (US Sales Only), PC A10/MF A01.

The report presents experimental results of a small lower plenum break test of SB-PV-01 conducted at the large-Scale Test Facility (LSTF) of the Rig-of-Safety Assessment (ROSA)-IV program. This test simulates a loss-of-coolant accident (LOCA) caused by instrument tubes break (break area corresponds to 0.5% of the cold leg flow area) in a Westinghouse-type pressurized water reactor (PWR) assuming both manual actuation for all of the high pressure injection (HPI) systems and failure of the auxiliary feedwater systems. The report clarifies long-term system responses, especially the core cooling conditions related to the primary mass inventory. Also it clarifies break location effects on small break LOCA phenomena by comparing other five similar LOCA tests with break locations at cold leg, hot leg, upper head, pressurizer top (TMI-type) and SG U-tubes. It is coucluded that the lower plenum break is the severest on core heatup due to the highest break flow rate and the least primary mass recovery after the ECCS among the six tests.

36157 (Juel-Spez–477) **On the accident behaviour of the HTR-100. A risk-oriented analysis.** Bongartz, R.; Degen, G.; Hennings, W.; Marx, J.; Mertens, J.; David, P.H.; Jahn, W.; Meister, G.; Rehm, W.; Wolters, J. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung. Dec 1988. 114p. (In German). Order Number DE89788400/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

The safety concept was analysed with respect to its balance, and the radiological risk was classified and quantified. Transients, leaks at the primary circuit, leaks at the steam generator and earthquakes were taken into account as initiating events. The analysis was performed in close interrelation with the planning process and provided indications of improvements to the accident control concept. Accidents involving loss of afterheat removal only contribute insignificantly to the radiological risk of the HTR-100 since cooling of the fuel elements sufficing to retain fission products is largely self-supporting. Essential contributions are made, on the other hand, by sequences initiated by a leak in a heating tube of the steam generator; its operational plate out activity may in part be released into the environment, possibly accompanied by fission gases from defective fuel particles. Leaks at the primary circuit are of comparable relevance; their radiological source term is significantly lower, but their frequency is higher. The risk contribution possibly caused by earthquakes proved to be negligible. In all cases emissions are so small that calculations of accident consequences do not reveal any lethal doses and practically no stochastic case of death due to cancer, and this without any immediate protection measures, long-term resettlement or decontamination. The integral risk of late fatalities is in the order of 10^{-7} per plant year; a number of sufficiently rare accident sequences provide contributions of the same order of magnitude. The doses from sequences possibly to be defined as design basis accidents remain far below the corresponding accident planning values.

36158 (LA-UR–89-1178) **Safety testing program for the Galileo mission radioisotope thermoelectric generator.** Cull, T.A. Los Alamos National Lab., NM (USA). 1989. 15p. Sponsored by DOE Nuclear Energy. DOE Contract W-7405-ENG-36. (CONF-890780–1: 9. international system safety conference, Long Beach, California, USA, 17-20 Jul 1989). Order Number DE89011192/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The major design requirement for any space nuclear power system is to minimize the potential for interaction of the radioactive materials with Earth's population and environment. All previous space power systems were launched on expendable launch vehicles (ELVs), so the design emphasis for the GPHS was on surviving the most severe ELV accident environments (launch pad explosion and solid propellant fire) and on surviving accident environments resulting from spacecraft failure (reentry and land impact). 14 refs., 4 figs., 2 tabs.

36159 (NUREG/CR–3469-Vol.4) **Occupational dose reduction at nuclear power plants: Annotated bibliography of selected readings in radiation protection and ALARA: Volume 4.** Khan, T.A.; Baum, J.W. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications; Brookhaven National Lab., Upton, NY (USA). Jun 1989. 121p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (BNL-NUREG–51708-Vol.4). Available from NTIS, PC A06/MF A01 - GPO - OSTI.

This report is the fourth in the series of bibliographies supporting the efforts at the Brookhaven National Laboratory on dose reduction at nuclear power plants. Abstracts for this bibliography were selected from proceedings of technical meetings, journals, research

reports and searches of the DOE's Energy Data Base. The abstracts included in this report to operational health physics as well as other subjects which have a bearing on dose reduction at nuclear power plants, such as stress corrosion, cracking, plant chemistry, use of robotics and remote devices, etc. Material on improved design, materials selection, planning and other topics which are related to dose reduction efforts are also included. The report contains 327 abstracts as well as subject and author indices. All information in the current volume is also available from the ALARA Center's bulletin board service which is accessible by personal computers with the help of a modem. The last section of the report explains the features of the bulletin board. The bulletin board will be kept up-to-date with new information and should be of help in keeping people current in the area of dose reduction.

36160 (NUREG/CR–4409-Vol.3) **Data base on dose reduction research projects for nuclear power plants: Volume 3.** Khan, T.A.; Baum, J.W. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications; Brookhaven National Lab., Upton, NY (USA). May 1989. 181p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (BNL-NUREG–51934-Vol.3). Available from NTIS, PC A08/MF A01 - GPO - OSTI.

This is the third volume in a series of reports that provide information on dose-reduction research and health physics technology for nuclear power plants. The information is taken from data base maintained by Brookhaven National Laboratory's ALARA Center for the Nuclear Regulatory Commission. This report presents information on 80 new projects, covering a wide area of activities. Projects on steam generator degradation, decontamination, robotics, improvement in reactor materials, and inspection techniques, among others, are described in the research section. The section on health physics technology includes some simple and very cost-effective projects to reduce radiation exposures. Collective dose data from the United States and other countries are also presented. In the conclusion, we suggest that although new advanced reactor design technology will eventually reduce radiation exposures at nuclear power plants to levels below serious concern, in the interim an aggressive approach to dose reduction remains necessary. 20 refs.

36161 (NUREG/CR–4961) **A summary of hydrogen-air detonation experiments.** Guirao, C.M.; Knystautas, R.; Lee, J.H. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Sandia National Labs., Albuquerque, NM (USA); McGill Univ., Montreal, PQ (Canada). Dept. of Mechanical Engineering. May 1989. 78p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (SAND–87-7128). Available from NTIS, PC A05/MF A01 - GPO - OSTI.

Dynamic detonation parameters are reviewed for hydrogen-air-diluent detonations and deflagration-to-detonation transitions (DDT). These parameters include the characteristic chemical length scale, such as the detonation cell width, associated with the three-dimensional cellular structure of detonation waves, critical transmission conditions of confined detonations into unconfined environments, critical initiation energy for unconfined detonations, detonability limits, and critical conditions for DDT. The detonation cell width, which depends on hydrogen and diluent concentrations, pressure, and temperature, is an important parameter in the prediction of critical geometry-dependent conditions for the transmission of confined detonations into unconfined environments and the critical energies for the direct initiation of unconfined detonations. Detonability limits depend on both initial and boundary conditions and the limit has been defined as the onset of single head spin. Four flame propagation regimes have been identified and the criterion for DDT in a smooth tube is discussed. 108 refs., 28 figs., 5 tabs.

36162 (NUREG/CR–5227-Suppl.1) **Fitness for duty in the nuclear power industry: A review of technical issues.** Moore, C.; Barnes, V.; Hauth, J.; Wilson, R.; Fawcett-Long, J.; Toquam, J.; Baker, K.; Wieringa, D.; Olson, J.; Christensen, J. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Inspection and Safeguards; Pacific Northwest Lab., Richland, WA (USA); Battelle Human Affairs Research Center, Seattle, WA (USA). May 1989. 174p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC06-76RL01830. (PNL–6652-Suppl.1;BHARC–700/88/018-Suppl.1). Available from NTIS, PC A08/MF A01 - GPO - OSTI.

This report presents information gathered and analyzed in support of the US Nuclear Regulatory Commission's (NRC's) efforts to develop a rule that will ensure that workers with unescorted access to protected areas of nuclear power plants are fit for duty. This report supplements information previously published in NUREG/CR-5227, Fitness for Duty in the Nuclear Power Industry: A Review of Technical Issues (Barnes et al., 1988). The primary potential fitness-for-duty concern addressed in both of these reports is impairment caused by substance abuse, although other fitness concerns are discussed. This report addresses issues pertaining to workers' use and misuse of alcohol, prescription drugs, and over-the-counter drugs as fitness-for-duty concerns; responds to several questions raised by NRC Commissioners; discusses subversion of the chemical testing process and methods of preventing such subversion; and examines concerns about the urinalysis cutoff levels used when testing for marijuana metabolites, amphetamines, and phencyclidine (PCP).

36163 (NUREG/CR–5252) **Aerosol sampling and Transport Efficiency Calculation (ASTEC) and application to surtsey/DCH aerosol sampling system: Code version 1.0: Code description and user's manual.** Yamano, N.; Brockmann, J.E. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Sandia National Labs., Albuquerque, NM (USA). May 1989. 147p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (SAND–88-1447). Available from NTIS, PC A - GPO - OSTI.

This report describes the features and use of the Aerosol Sampling and Transport Efficiency Calculation (ASTEC) Code. The ASTEC code has been developed to assess aerosol transport efficiency source term experiments at Sandia National Laboratories. This code also has broad application for aerosol sampling and transport efficiency calculations in general as well as for aerosol transport considerations in nuclear reactor safety issues. 32 refs., 31 figs., 7 tabs.

36164 (NUREG/CR–5291) **Closeout of IE Bulletin 80-09: Hydramotor actuator deficiencies.** Foley, W.J.; Dean, R.S.; Hennick, A. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Operational Events Assessment; Parameter, Inc., Elm Grove, WI (USA). Jun 1989. 13p. Sponsored by Nuclear Regulatory Commission. (PARAMETER/IE–182). Available from NTIS, PC A03/MF A01 - GPO - OSTI.

Documentation is provided in this report for the closeout of IE Bulletin 80-09 on the safety-related subject of ITT General Controls (ITT-GC) Hydramotor actuators models AH-90 and NH-90. The problems reported about inadequate springs and faulty sizing could affect the operation of safety-related equipment installed in nuclear power facilities. Closeout is based on the implementation and verification of actions required by this bulletin. It is concluded that the concerns of the bulletin have been resolved. Evaluation of utility responses and NRC/Region inspection reports indicates that the bulletin is closed for all of the 119 nuclear power reactor facilities in operation or under construction.

36165 (NUREG/CR–5347) **Recommendations for resolution of public comments on USI [Unresolved Safety Issues] A-40, "Seismic Design Criteria".** Philippacopoulos, A.J. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution; Brookhaven National Lab., Upton, NY (USA). Jun 1989. 151p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (BNL-NUREG–52191). Available from NTIS, PC A08/MF A01 - GPO - OSTI.

In June 1988 the Nuclear Regulatory Commission (NRC) issued for public comment the proposed Revision 2 of the Standard Review Plan (SRP) Sections 2.5.2, 3.7.1, 3.7.2. and 3.7.3. Comments were received from six organizations. Brookhaven National Laboratory (BNL) was requested by NRC to provide expert consultation in the seismic and soil-structure interaction areas for the review and resolution of these comments. For this purpose, a panel of consultants was established to assist BNL with the review and evaluation of the public comments. This review was carried out during the period of October 1988 through January 1989. Many of the suggestions given in the public comments were found to be significant and

a number of modifications to appropriate SRP sections are recommended. Other public comments were found to have no impact on the proposed Revision 2 of the SRP. Major changes are recommended to the SRP sections dealing with (a) Power Spectral Density (PSD) and ground motion requirements and (b) soil-structure interaction requirements. This report contains specific recommendations to NRC for resolution of the public comments made on the proposed Revision 2 of the SRP.

36166 (NUREG/CR–5379-Vol.1) **Nuclear plant service water system aging degradation assessment: Phase 1.** Jarrell, D.B.; Johnson, A.B. Jr.; Zimmerman, P.W.; Gore, M.L. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 75p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC06-76RL01830. (PNL–6560-Vol.1). Available from NTIS, PC A04/MF A01 - GPO - OSTI.

The initial phase of an aging assessment of nuclear power plant service water systems (SWSs) was performed by the Pacific Northwest Laboratory to support the Nuclear Regulatory Commission Nuclear Plant Aging Research (NPAR) program. The SWS was selected for study because of its essential role in the mitigation of and recovery from accident scenarios involving the potential for core-melt. The objectives of the SWS task under the NPAR program are to identify and characterize the principal aging degradation mechanisms relevant to this system and assess their impact on operational readiness, and to provide a methodology for the mitigation of aging on the service water aspect of nuclear plant safety. The first two of these objectives have been met and are covered in this Phase 1 report. A review of available literature and data-base information indicated that motor operated valve torque switches (an electro-mechanical device) were the prime suspect in component service water systems failures. More extensive and detailed data obtained from cooperating utility maintenance records and personnel accounts contradicted this conclusion indicating that biologic and inorganic accumulation and corrosive attack of service water on component surfaces were, in fact, the primary degradation mechanisms. A review of the development of time dependent risk assessment (aging) models shows that, as yet, this methodology has not been developed to a degree where implementation is reliable. Improvements in the accuracy of failure data documentation and time dependent risk analysis methodology should yield significant gains in relating aging phenomena to probabilistic risk assessment. 23 refs., 8 figs., 10 tabs.

36167 (ORNL/FTR–3093) **[International conference on Thermal reactor safety, October 2-7, 1988, Avignon, France]: Foreign trip report.** Malinauskas, A.P. Oak Ridge National Lab., TN (USA). 27 Oct 1988. 10p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. Order Number DE89014752/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler presented an invited paper entitled "Chemical Factors Affecting Fission Product Release and Transport" at the International Conference on Thermal Reactor Safety that was held October 2-7, 1988, in Avignon, France, and participated in the conference as a member of the technical program committee. The traveler also agreed to summarize the conference for the journal Nuclear Safety. This report is a presentation of that summary.

36168 Application of probabilistic fracture mechanics to the pressurized-thermal-shock issue. Ball, D.G. (Computing and Telecommunications Div., Martin Marietta Energy Systems, Inc., Oak Ridge, TN (US)). v.v of Proceedings of the eighteenth national symposium on fracture mechanics. Read, D.T.; Reed, R.P. ASTM, Philadelphia, PA (1988). (CONF-850679–: 18. American Society for Testing and Materials national symposium on fracture mechanics, Boulder, Colorado, USA, 25-27 Jun 1985).

As a part of the Nuclear Regulatory Commission (NRC) effort to obtain a resolution to the pressurized water reactor (PWR) pressurized-thermal-shock (PTS) issue, a probabilistic approach has been applied that includes a probabilistic fracture-mechanics (PFM) analysis. The PFM analysis is performed with OCA-P, a computer code that performs thermal, stress, and fracture-mechanics analyses and estimates the conditional probability of vessel failure, P(F vertical bar E), using Monte Carlo techniques. The stress intensity factor (K_I) is calculated for two- and three-dimensional surface flaws using superposition techniques and influence coefficients. Importance-sampling techniques are used, as necessary, to limit to a reasonable value the number of vessels actually calculated. Analyses of three PWR plants indicate that the critical initial flaw depth is very small (5 to 15 mm), the benefit of warm prestressing and the role of crack arrest are transient dependent, crack arrest does not occur for the dominant transients, and the single largest uncertainty in the overall probabilistic analysis is the number of surface flaws per vessel.

36169 Overview of the development of seismic safety assessment techniques for nuclear power plants. Cummings, G.E. (Lawrence Livermore National Lab., CA (USA)); Murray, R.C. v. of Probabilistic safety assessment and risk management PSA '87. Vol. 1. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

Seismic safety of nuclear power plants has been a concern for a number of years and in some cases has had a strong influence on plant design. To put into proper perspective the earthquake risk from nuclear plants and the elements of the design which contribute to that risk, seismic risk assessment techniques have been developed and utilized. This paper describes some of these seismic risk assessment techniques and presents results of their application to two nuclear power plants. From the results of these and other seismic risk assessments, information was developed to make possible an efficient method for assessing safety margins at nuclear plants with respect to earthquakes. This method and the results from using the method are also described.

36170 Seismic margin screening insights for light water reactors. Prassinos, P.G. (Lawrence Livermore National Lab., CA (USA)); Cummings, G.E.; Amico, P.J. v. of Probabilistic safety assessment and risk management PSA '87. Vol. 1. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

A study of the results of several seismic PRAs was performed to develop a screening approach for the assessment of the seismic margin of nuclear power plants. This screening approach combines both systems insights and fragility information to simplify the margin review process. The purpose of this paper is to present the basis and method used for the development of the systems screening portion of the seismic margin review methodology.

36171 Seismic risk of a BWR. Wells, J.E. (Lawrence Livermore National Lab., CA (USA)); Murray, R.C. v. of Probabilistic safety assessment and risk management PSA '87. Vol. 1. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

The simplified seismic risk methodology developed in the U.S. NRC Seismic Safety Margins Research Program (SSMRP) was demonstrated by its application to the Zion power plant (PWR). This simplified seismic risk methodology was applied to the LaSalle nuclear power plant, a BWR to demonstrate its applicability, and if possible, to provide a basis of comparison of seismic risk between a PWR and a BWR when analyzed with comparable methodology and assumptions. This paper describes the seismic risk assessment methodology used to assess the LaSalle nuclear power plant. (orig./HSCH).

36172 Precracking and computerized single-specimen J_{Ic} determination for irradiated three-point bend specimens. Haggag, F.M. (Oak Ridge National Lab., Oak Ridge, TN (US)); Richardson, A.K. v.v of Proceedings of the eighteenth national symposium on fracture mechanics. Read, D.T.; Reed, R.P. ASTM, Philadelphia, PA (1988). (CONF-850679–: 18. American Society for Testing and Materials national symposium on fracture mechanics, Boulder, Colorado, USA, 25-27 Jun 1985).

An experimental procedure is described for precracking and computerized single-specimen J_{Ic} testing of irradiated three-point bend specimens. The specimens were automatically precracked in cantilever bending at constant deflection. The J_{Ic} values determined by

the single-specimen unloading compliance technique were found to be in close agreement with multiple-specimen values. The J_{Ic} testing system comprised a three-point bend fixture and a furnace mounted on a screw-driven Instron testing machine, a Hewlett-Packard computer, and a data acquisition system. This procedure was found to be successful and cost effective in precracking and J_{Ic} testing of the irradiated specimens.

36173 Accident sequence precursor program: Methods improvements and current results. Minarick, J.W. (Science Applications International Corp., Oak Ridge, TN (USA)); Manning, F.M.; Harris, J.D. v. of Probabilistic safety assessment and risk management PSA '87. Vol. 1. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

Changes in the U.S. NRC Accident Sequence Precursor program methods since the initial program evaluations of 1969-81 operational events are described, along with insights from the review of 1984-85 events. For 1984-85, (1) the number of significant precursors was consistent with the number observed in 1980-81, (2) dominant sequences associated with significant events were reasonably consistent with PRA estimates for BWRs, but lacked the contribution due to small-break LOCAs previously observed and predicted in PWRs, and (3) the frequency of initiating events and non-recoverable system failures exhibited some reduction compared to 1980-81. Operational events which provide information concerning additional PRA modelling needs are also described.

36174 Microcomputer-based systems and plant analyses - the IRRAS and SARA systems. Sattison, M.B. (Idaho National Engineering Lab., Idaho Falls (USA)); Russell, K.D.; Van Siclen, V.S.; Henry, D.M.; Cathey, N.G. v. of Probabilistic safety assessment and risk management PSA '87. Vol. 1. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

The Integrated Reliability and Risk Analysis System (IRRAS) and the System Analysis and Risk Assessment (SARA) system are microcomputer-based programs developed for the USNRC. These two software packages form the backbone of the USNRC's plan for risk-based decisionmaking and safety goal implementation. They are designed to provide the probabilistic risk assessment (PRA) analyst with a set of tools for analysis as well as to give the regulator the means of quickly assessing the impact on plant risk of changes in the design or operation of a plant due to proposed regulation. (orig./HSCH).

36175 Evaluation of SCC test methods for Inconel 600 in low-temperature aqueous solutions. Newman, R.C. (Corrosion Science Group, Dept. of Nuclear Energy, Brookhaven National Lab., Upton, NY (US)); Roberge, R.; Bandy, R. v.v of Environment-sensitive fracture: Evaluation and comparison of test methods. Dean, S.W.; Pugh, E.N.; Ugiansky, G.M. ASTM, Philadelphia, PA (1984). (CONF-820495–: ASTM symposium on environment sensitive fracture: evaluation and comparison of test methods, Gaithersburg, MD, USA, 25-28 Apr 1982).

In late 1981, widespread leakage was encountered in Alloy 600 steam generator tubing at the Three Mile Island Unit 1 nuclear power plant. The phenomenon was identified as low-temperature intergranular stress-corrosion cracking (SCC) initiated from the inner surfaces of the tubes exposed to the primary coolant. A testing program was initiated to examine the material and environmental factors relevant to these failures, which were found to be associated with sensitization of the material and contamination of the coolant by air and sodium thiosulfate. The test solutions contained 1.3% boric acid with various additions of sulfur compounds and lithium hydroxide. Constant extension rate testing was used as the primary tool to examine environmental effects such as the inhibition of cracking by lithium hydroxide. Important effects of crack initiation frequency on the specimen potential (and therefore crack velocity) are demonstrated. In some of these tests, straining was interrupted following crack initiation, and the effects of further environmental additions were monitored by following the load decay at constant total strain. This procedure generally resulted in a different ranking of the environments. U-bend tests showed that the ranking of different sulfur-containing environments was also highly dependent on the metal heat treatment.

36176 Improved reliability of residual heat removal capability in pressurized water reactors. Chu Tsonglun (Brookhaven National Lab., Upton, NY (USA)); Fitzpatrick, R.; Yoon, W.H. v. of Probabilistic safety assessment and risk management PSA '87. Vol. 2. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

Operational experience of U.S. PWRs indicates that numerous loss of Residual Heat Removal (RHR) events have occurred during plant shutdown. Of particular significance is the loss of RHR suction due to the inadvertent closure of the RHR suction/isolation valves or an excess lowering of the water level in the reactor vessel. In the absence of prompt mitigative action by the operator, the core may become uncovered. Various design/operational changes have been proposed. The objective of this paper is to estimate the improvement in the RHR reliability and the risk reduction potential provided by those proposed RHR design/operational changes. The benefits of those changes are expressed in terms of the reduction in the frequence of loss-of-cooling events and the frequency of core damage. (orig./HSCH).

36177 NUREG-1150 risk assessment methodology and results. Benjamin, A.S. (Sandia National Labs., Albuquerque, NM (USA)); Boyd, G.J.; Lewis, S.R.; Amos, C.N.; Cunningham, M.A.; Murphy, J.A. v. of Probabilistic safety assessment and risk management PSA '87. Vol. 2. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). DOE Contract AC04-76DP00789. (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

NUREG-1150 constitutes a full-scope reassessment of the risks to the public from several light water reactor plants with various containment types. Emphasis has been placed on determining the magnitude and character of the uncertainties, rather than focusing upon a point estimate. The risk-reduction potential of proposed plant modifications (backfits and procedural changes) has also been studied, and their costs and benefits have been evaluated. It has been found that the risks from internal events are generally lower than previously evaluated in the Reactor Safety Study (RSS). However, certain unresolved phenomenological issues cause the tops of the uncertainty bands to appear at levels that are comparable to or higher than the RSS point estimates. The issues that are important vary from plant to plant. Most of the postulated plant modifications do not appear to be cost-effective, although a few procedural changes are possible exceptions. Several reviews of this work are in progress, and a second iteration is being performed to include external events, incorporate new technical information, and address comments.

36178 Interfacing systems LOCAs at boiling water reactors. Chu Tsonglun (Brookhaven National Lab., Upton, NY (USA)); Fitzpatrick, R.; Stoyanov, S. v. of Probabilistic safety assessment and risk management PSA '87. Vol. 2. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

The Reactor Safety Study identified an interfacing system LOCA in a PWR as a significant contributor to risk from accidents that result in severe core damage. For BWRs, interfacing LOCA have typically either not been considered in probabilistic risk analyses, or if considered, were judged to contribute little to the risk estimate because of their perceived low frequency of occurrence. However, recent operating experience indicates that the pressure isolation valves (PIVs) in BWRs may not adequately protect against overpressurization of low pressure systems. In fact, four events of overpressurization of low pressure systems have already occurred at BWRs. The objective of this paper is to present the results of a study which analyzed interfacing system LOCA at several BWRs. The BWRs were selected to best represent a spectrum of BWRs in service using industry operating event experience and plant-specific information/configurations. The results presented here include some

possible changes in test requirements/practices as well as an evaluation of their reduction potential in terms of core damage frequency (CDF). (orig./HSCH).

36179 Generic safety insights for inspection of boiling water reactors. Higgins, J.C. (Brookhaven National Lab., Upton, NY (USA)); Hillmann, B.M. v. of Probabilistic safety assessment and risk management PSA '87. Vol. 2. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

Generic safety insights, to aid in the inspection of U.S. Boiling Water Reactors (BWRs), are developed using existing BWR Probabilistic Risk Assessment (PRAs). These generic insights can be used directly to inspect BWRs without PRAs or to develop detailed plant specific inspection guides for those plants without PRAs. Methodology as well as some examples of the generic insights are presented.

36180 DOE advanced reactor severe accident program (ARSAP) - an overview. Fontana, M.H. (IT Corp., Oak Ridge, TN (USA)); Buhl, R.; Copp, R.D. v. of Probabilistic safety assessment and risk management PSA '87. Vol. 3. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

The U.S. DOE has implemented the Advanced Reactor Severe Accident Program (ARSAP) to assure resolution of severe accident related issues and to support industry efforts to certify standardized advanced light water reactors. This paper provides an overview of the program. (orig./HSCH).

36181 Application of generic PRA insights to NRC inspection. Fisher, J.E. (Idaho National Engineering Lab., Idaho Falls (USA)); Gregg, R.E.; Hinton, M.F.; Wright, R.E.; Hillman, B.M. v. of Probabilistic safety assessment and risk management PSA '87. Vol. 3. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). DOE Contract AC07-76ID01570. (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

The NRC has developed a program that uses probabilistic risk assessment (PRA) results to produce plant specific inspection guidelines for use by NRC inspectors. Because only about one-quarter of the operating United States (U.S.) plants have PRAs, a generic methodology has been proposed for the production of inspection guidelines for plants without PRAs. The first application of this proposed generic method was to a plant which has a PRA, so a comparison of the inspection guidance produced by the PRA-based and generic methods could be made. An evaluation of the comparison from that application is provided. (orig./HSCH).

36182 PRISIM - a plant risk status information management system for NRC inspectors. Reilly, H.J. (Idaho National Engineering Lab., Idaho Falls (USA)); Glynn, J.C.; Campbell, D.J. v. of Probabilistic safety assessment and risk management PSA '87. Vol. 3. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). DOE Contract AC07-76ID01570. (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

The Plant Risk Status Information Management System (PRISIM) is a microcomputer program that presents results of probabilistic risk assessments (PRAs), and related informations, for use by US-NRC decisionmakers. Plant-specific PRISIMs have been developed for three nuclear plants in the United States. The usefulness of PRISIM for these plants is now under evaluation, and an improved PRISIM is being developed. (orig./HSCH).

36183 Chernobyl-4 accident analysis. Purvis, E.E. (Department of Energy, Washington, DC (USA)); Spencer, B. v. of Probabilistic safety assessment and risk management PSA '87. Vol. 3. Verl. TUEV Rheinland, Koeln, Germany, F.R. (1987). (CONF-870820–: PSA 87: international topical meeting on probabilistic safety assessment and risk management, Zurich, Switzerland, 31 Aug - 4 sep 1987).

The U.S. Department of Energy formed a team of experts in July of 1986 to better understand the Chernobyl-4 accident. The team's analyses confirmed the plausibility of the results of Soviet analyses presented at the Chernobyl-4 Post-Accident Review meeting held 1986 in Vienna, Austria. The accident was a loss of flow induced (by flow reduction) transient overpower (LOF TOP) excursion that took place in two stages. This paper will concentrate on the accident energetics and, in particular, on some new information. (orig./HSCH).

36184 Characterization and chemistry of fission products released from LWR fuel under accident conditions. Norwood, K.S. (Oak Ridge Nat. Lab., Oak Ridge, TN (US)); Collins, J.L.; Osborne, M.F.; Lorenz, R.A.; Wichner, R.P. v.v of Proceedings of the American Nuclear Society meeting on fission-product behaviour and source term research. American Nuclear Society, La Grange Park, IL (1985). (CONF-8507160–: ANS meeting on fission product behaviour and source term research, Snowbird, Utah, USA, 15-19 Jul 1985).

Segments from commercial LWR fuel rods have been tested at temperatures between 1400 and 2000^{0}C in a flowing steam-helium atmosphere to simulate severe accident conditions. The primary goals of the tests were to determine the rate of fission product release and to characterize the chemical behavior. This paper is concerned primarily with the identification and chemical behavior of the released fission products with emphasis on antimony, cesium, iodine, and silver. The iodine appeared to behave primarily as cesium iodide and the antimony and silver elements, while cesium behavior was much more complex.

36185 Mass spectrometric study of the release of volatile fission products from irradiated LWR fuel. Johnson, I. (Argonne Nat. Lab., Argonne, IL (US)); Steidl, D.V.; Johnson, C.E. v.v of Proceedings of the American Nuclear Society meeting on fission-product behaviour and source term research. American Nuclear Society, La Grange Park, IL (1985). (CONF-8507160–: ANS meeting on fission product behaviour and source term research, Snowbird, Utah, USA, 15-19 Jul 1985).

The chemical form and rate of release of volatile fission products (i.e., Xe, Kr, Cs, Te, I,...) effused from a section of an irradiated LWR fuel pin are being studied using quadrupole mass spectrometry. The released volatile fission products must effuse through a hole drilled in the cladding to reach the ionizer of the mass spectrometer. Experiments to a temperature of 1450^{0}C have identified krypton, xenon, cesium, tellurium, and atomic iodine (very weak signal) as the species released from the fuel. The source of the atomic iodine, i.e. dissociation of cesium iodide or dissociation of molecular iodine, has yet to be resolved. The observed rate of release of xenon is several orders of magnitude lower than previously reported. In complimentary experiments on nonradioactive material, the reaction of tellurium with the Zircaloy cladding was found to hinder its release. Above 1200^{0}C, gaseous SnTe was observed; its formation is attributed to reaction of the tin (in the cladding) with $ZrTe_2$.

36186 Iodine volatility. Beahm, E.C. (Oak Ridge Nat. Lab., Oak Ridge, TN (US)); Shockley, W.E. v.v of Proceedings of the American Nuclear Society meeting on fission-product behaviour and source term research. American Nuclear Society, La Grange Park, IL (1985). (CONF-8507160–: ANS meeting on fission product behaviour and source term research, Snowbird, UT, USA, 15-19 Jul 1985).

The authors are carrying out a program, the ultimate aim of which is to couple experimental aqueous iodine volatiles to a fission product release model. Iodine partition coefficients for inorganic iodine have been measured during hydrolysis and radiolysis. The hydrolysis experiments have illustrated the importance of reaction time on iodine volatility. However, radiolysis effects can override hydrolysis in determining iodine volatility. In addition, silver metal in radiolysis samples can react to form silver iodide accompanied by a decrease in iodine volatility. The authors are presently engaged in the process of coupling experimental data to an iodine transport and release model.

36187 LWR aerosol containment experiments (LACE) program and initial test results. Muhlestein, L.D. (Westinghouse Hanford Co., Richland, WA (US)); Hilliard, R.K.; Bloom, G.R.; McCormack, J.D.; Rahn, F.J. v.v of Proceedings of the American Nuclear Society meeting on fission-product behaviour and source term research. American Nuclear Society, La Grange Park, IL

(1985). (CONF-8507160–: ANS meeting on fission product behaviour and source term research, Snowbird, Utah, USA, 15-19 Jul 1985).

The LWR aerosol containment experiments (LACE) program is described. The LACE program is being performed at the Hanford Engineer Development Laboratory (operated by Westinghouse Hanford Company) and the initial tests are sponsored by EPRI. The objectives of the LACE program are: to demonstrate, at large-scale, inherent radioactive aerosol retention behavior for postulated high consequence LWR accident situations; and to provide a data base to be used for aerosol behavior . Test results from the first phase of the LACE program are presented and discussed. Three large-scale scoping tests, simulating a containment bypass accident sequence, demonstrated the extent of agglomeration and deposition of aerosols occurring in the pipe pathway and vented auxiliary building under realistic accident conditions. Parameters varied during the scoping tests were aerosol type and steam condensation.

36188 A sensitivity of aerosol agglomeration and deposition using the MAEROS model. Leigh, C.D. (Sandia Nat. Lab., Albuquerque, NM (US)); Helton, J.C. v.v of Proceedings of the American Nuclear Society meeting on fission-product behaviour and source term research. American Nuclear Society, La Grange Park, IL (1985). (CONF-8507160–: ANS meeting on fission product behaviour and source term research, Snowbird, Utah, USA, 15-19 Jul 1985).

In support of the MELCOR program, a study of the sensitivities and uncertainties associated with MAEROS aerosol code predictions has been performed for TMLB accident conditions using Latin hypercube sampling techniques and regression analysis methods. Agglomeration and deposition in the reactor containment of two aerosol components, and in-vessel aerosol and an ex-vessel aerosol, were examined by varying the values of 24 code input parameters that defined containment geometry, containment thermal-hydraulic conditions, aerosol source characteristics, and agglomeration and deposition rate constants. Twenty aerosol size sections, spanning the size range of 0.01 to 200 μ were used to develop the sensitivities and uncertainties associated with code predictions of the total suspended mass, the time to 90 percent deposition, and the total integrated gas borne mass density of each aerosol component. These sensitivities and uncertainties were found to depend principally on the following four input parameters: the source strength of the ex-vessel aerosol, the agglomeration shape factor, the turbulent energy dissipation rate, and the particle mass density.

36189 Phenomenological uncertainties in the suspended radionuclide concentrations in containment during severe LWR accidents. Williams, D.C. (Sandia Nat. Labs., Albuquerque, NM (US)); Murata, K.K.; Tills, J.L. v.v of Proceedings of the American Nuclear Society meeting on fission-product behaviour and source term research. American Nuclear Society, La Grange Park, IL (1985). (CONF-8507160–: ANS meeting on fission product behaviour and source term research, Snowbird, Utah, USA, 15-19 Jul 1985).

CONTAIN, a code for integrated analysis of containment phenomenologies in complex LWR sever accident sequences, is being applied in a program for evaluating the uncertainties in USNRC-sponsored efforts to better define LWR accident source terms. The Surry TMLB sequence is studied in detail. Aerosol agglomeration uncertainties are found to contribute about an order of magnitude to the overall uncertainty in suspended radionuclides (almost entirely downward uncertainty; i.e., downward with respect to current base case estimates such as BMI-2104). Containment compartmentalization effects contribute substantial uncertainties in either direction, while effects due to complex multicomponent aerosol compositions contribute lesser, but still potentially significant uncertainties (mostly downward). Incomplete treatment of radionuclide decay chains can contribute factor-of-two upward uncertainties.

36190 Fission product behaviour during the TMI-2 accident. Tooper, F.E. (USDOE, Washington, DC (US)). v.v of Proceedings of the American Nuclear Society meeting on fission-product behaviour and source term research. American Nuclear Society, La Grange Park, IL (1985). (CONF-8507160–: ANS meeting on fission product behaviour and source term research, Snowbird, Utah, USA, 15-19 Jul 1985).

An overview of the TMI-2 accident analysis and fission product behavior research activities performed for the DOE is presented. Included in the overview are the latest results from the TMI-2 accident sequence assessment. Concomitant implications related to fission product transport, deposition, and retention mechanisms for core metal dominant accident sequences are also discussed. Other areas are being addressed as part of the TMI-2 accident sequence assessment, such as core degradation phenomena including debris bed coolability. A summary of observation is provided.

36191 TMI-2 core debris analytical methods and results. Akers, D.W. (EG and G Idaho Inc., Idaho Falls, ID (US)); Cook, B.A. v.v of Proceedings of the American Nuclear Society meeting on fission-product behaviour and source term research. American Nuclear Society, La Grange Park, IL (1985). (CONF-8507160–: ANS meeting on fission product behaviour and source term research, Snowbird, Utah, USA, 15-19 Jul 1985).

A series of six grab samples was taken from the debris bed of the TMI-2 core in early September 1983. Five of these samples were sent to the Idaho National Engineering Laboratory for analysis. Presented is the analysis strategy for the samples, and some of the data obtained from the early stages of examination of the samples (i.e., particle size-analysis, gamma spectrometry results, and fissile/fertile material analysis).

36192 TMI-2 leadscrew radionuclide deposition and characterization. Vinjamuri, K. (EG and G Idaho Inc., Idaho Falls, ID (US)); Akers, D.W.; Hobbins, R.R. v.v of Proceedings of the American Nuclear Society meeting on fission-product behaviour and source term research. American Nuclear Society, La Grange Park, IL (1985). (CONF-8507160–: ANS meeting on fission product behaviour and source term research, Snowbird, Utah, USA, 15-19 Jul 1985).

Two leadscrews, H8 and B8, from the TMI-2 reactor were examined by EG and G Idaho Inc., at the Idaho National Engineering Laboratory. Metallography, hardness measurements, and chemical and radiological analyses were conducted on samples cut from the leadscrews. Hardness measurements and microstructure analysis suggest that a significant temperature gradient existed between the portions of the leadscrews closest to the core and the portions near the top of the upper plenum, and leadscrew B8 experienced a slower cooling rate than H8. Chemical analyses indicate that UO_2 and Zr were deposited on surfaces closer to the core. Radiological analyses suggest that a majority of the H8 radionuclides are insoluble in strong acid solutions. In contrast, the majority of the B8 radionuclides are soluble in strong acidic solutions. Significant radioactivity is associated with the smallest size ($\leq$0.45 μm) brush off debris. The greatest activity was found close to the top of the upper plenum.

36193 Radionuclide distribution in TMI-2 reactor building basement liquids and solids. Horan, J.T. (EG and G Idaho Inc., Idaho Falls, ID (US)); Keefer, D.G.; McIsaac, C.V. v.v of Proceedings of the American Nuclear Society meeting on fission-product behaviour and source term research. American Nuclear Society, La Grange Park, IL (1985). (CONF-8507160–: ANS meeting on fission product behaviour and source term research, Snowbird, Utah, USA, 15-19 Jul 1985).

Large quantities of radioactive water and some core debris solids were released to the reactor building basement during the March 1979 accident at Three Mile Island Unit 2 (TMI-2). A reactor building basement sampling and analysis program is underway to support fission product mass balance and source term studies, TMI-2 accident analysis, and decontamination planning. Liquid and solid samples were collected from a variety of locations to determine the composition, quantity, and distribution of the debris and fission products released to the basement environment. Basement water sources, sample history, and sampling techniques are discussed. Fuel, radionuclide content and elemental composition of liquid and solid samples are presented. Conclusions are presented on the partitioning of fission products within liquids and solids and on the transport paths within the basement area.

36194 Results of surface activity and radiation field measurements made during surface decontamination experiments

conducted at TMI-2. McIsaac, C.V. (EG and G Idaho Inc., Idaho Falls, ID (US)); Davis, C.M.; Horan, J.T.; Keefer, D.G. v.v of Proceedings of the American Nuclear Society meeting on fission-product behaviour and source term research. American Nuclear Society, La Grange Park, IL (1985). (CONF-8507160–: ANS meeting on fission product behaviour and source term research, Snowbird, Utah, USA, 15-19 Jul 1985).

The loss of coolant accident at TMI-2 exposed about 22000 square meters of concrete and metal surfaces within the reactor building to liquid and vapor-phase radionuclide contamination. During the course of the accident, floors and walls of the auxiliary fuel handling building were also contaminated. Since 1981 the decontamination of these surfaces has been conducted using water spray, strippable coating, and scabbling techniques. These decontamination studies have helped determine the distribution of radionuclides on building surfaces and the nature of the radionuclide penetration into surface coatings. In addition, in situ radiological surveys of decontamination effectiveness were performed. This paper reviews the results of these surface decontamination studies and presents conclusions on the nature and extent of reactor building contamination as a consequence of the TMI-2 accident.

36195 **Effects on consequences of the high steam content in LWR accident releases.** Spulak, R.G. Jr. (Sandia Nat. Labs., Albuquerque, NM (US)); Boughton, B.A.; Williams, D.C.; Cummings, J.C.; Alpert, D.J.; Richards, C.N.; Dunn, W.E. v.v of Proceedings of the American Nuclear Society meeting on fission-product behaviour and source term research. American Nuclear Society, La Grange Park, IL (1985). (CONF-8507160–: ANS meeting on fission product behaviour and source term research, Snowbird, UT, USA, 15-19 Jul 1985).

This research has addressed the possibility that condensation of steam during the release of containment gases and aerosol particles to the atmosphere after a coremelt accident could deposit a significant fraction of the radioactive material near the plant. This paper describes the modeling of accident releases including this 'rainout' and discusses the impact of the findings on risk predictions. The models include details of the hydrodynamics of the flow from containment, thermodynamics of the release mixture, explicit consideration of condensation on the radioactive aerosols, turbulent agglomeration of aerosols and water droplets, buoyant plume physics, and the dispersion and deposition of drops. The authors discuss the initial and boundary conditions which lead to significant rainout.

36196 **Sensitivity/uncertainty analysis for free-in-air tissue kerma due to initial radiation at Hiroshima and Nagasaki.** Lillie, R.A. (4832000); Broadhead, B.L.; Pace, J.V. III. *Nuclear Science and Engineering (USA)*, 100(2): 105-124 (Oct 1988).

Uncertainty estimates and cross correlations by range/survivor have been calculated for the Hiroshima and Nagasaki free-in-air (FIA) tissue kerma obtained from two-dimensional air/ground transport calculations. The uncertainties due to modeling parameter and basic nuclear transport data uncertainties were calculated for 700-, 1000-, and 1500-m ground ranges. Only the FIA tissue kerma due to initial radiation was treated in the analysis; the uncertainties associated with terrain and building shielding and phantom attenuation were not considered in this study. Uncertainties of –20% were obtained for the prompt neutron and secondary gamma kerma and 30% for the prompt gamma kerma at both cities. The uncertainties on the total prompt kerma at Hiroshima and Nagasaki are –18 and 15%, respectively. The estimated uncertainties vary only slightly by ground range and are fairly highly correlated. The total prompt kerma uncertainties are dominated by the secondary gamma uncertainties, which in turn are dominated by the modeling parameter uncertainties, particularly those associated with the weapon yield and radiation sources.

25 ENERGY STORAGE

Refer also to citation(s) 36370

2501 Magnetic

Refer also to citation(s) 36895, 36928

2506 Thermal

Refer also to citation(s) 36243, 36381, 36382, 36383, 36415

36197 (DOE/IR/05106–T54) **Thermal energy storage: An application guide for local governments.** Teji, D.S. Urban Consortium for Technology Initiatives (USA). Energy Task Force. Feb 1988. 63p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG02-78IR05106. Order Number DE89014913/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Thermal energy storage technology is a comparatively new technology that is receiving attention throughout the United States and the world. The main object of this strategy is to lower the peak electricity demand by shifting the peak demand (KW) and energy use (KWH) from high demand hours to low demand hours. This strategy is receiving favor from the utility industry, with special rebates often available to those who install thermal energy storage systems. In 1985, the Urban Consortium Energy Task Force formally approved funding for a project proposed by the City of Phoenix. The project selected was Thermal Storage Strategies For Energy Cost Reduction. This project was successfully completed with very interesting results and many lessons learned as a sideline. This project was implemented as a retrofit to the existing air conditioning system at the Century Branch Library of the City of Phoenix. In the conduct of this project, elaborate research on the technology was supported. Publications describing the latest relevant technology were studied, and several existing sites with similar applications were visited. There are jurisdictions where the potential for similar applications exist, but practical implementation is constrained by the lack of guidelines and experience. The purpose of this project is to provide other jurisdictions with ready-to-use guidelines applicable to their own specific situations.

36198 (ITL–8509, pp. 218-221) **An evaluation of solar heating systems with seasonal storage in New England. Systems using duct storage in rock and heat pump.** Breger, D.S. (Argonne National Lab., Argonne, IL, USA); Michaels, A.I. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This evaluation focuses on the New England region of the United States, and considers seasonal storage of solar energy using duct storage in rock and a heat pump. Adequate bedrock for large scale storage is available in the New England region and the climate, which includes cold, relatively cloudy winters and summers with substantial insolation, makes seasonal storage technology of particular interest. The general results of the analysis indicate that the optimized systems provide 75-80% of the low temperature demand load and 60-65% of the high temperature demand load with solar energy, with the remaining portion coming primarily from the heat pump electrical input energy. The annualized cost of the energy supplied by the system to the distribution network using the base case economic scenario is $44-52/MWh and $58-62/MWh for the low and high temperture loads, respectively. Energy costs in the New England area are comparable to these values. 3 refs., 4 figs., 1 tab.

36199 (ITL–8509, pp. 249-253) **Transient response of an in-ground vertical cylindrical heat exchanger. Thermal characterization of the soil.** Leroy, G. (Univ. de Nantes, Nantes Cedex, France). Intertask Ltd., Ottawa, ON (Canada). 1985. (In French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd international conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON,

Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A bidimensional, transitional model is presented of coupled heat transfers between a heat exchanger, consisting of two coaxial cylindrical tubes, and the soil. The model was used to study the influence of the nature of the walls, the thermal resistance of the exchanger-soil contact, the inertia of the heat transfer fluid and the walls, the flow regime, and the thermal characteristics of the ground, on the performance of the heat exchanger. The sensitivity of the model to conductivity, diffusivity, and thermal resistance of the exchanger-soil contact is tested. 5 refs., 4 figs., 1 tab.

36200 (ITL–8509, pp. 202-207) **Ground heat technology in Sweden.** Andersson, S. (AIB Consulting Engineers, Solna, Sweden). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Ground heat storage in Sweden normally refers to heat storage in rock, clay or peat. Bedrock suitable for different concepts of borehole heat stores is accessible in most parts of the country, whereas clay and peat in settled areas are concentrated in specific regions. A number of ground heat storage projects have been implemented during the last years in rock as well as in clay and peat. The projects are in different stages of follow up and evaluation. Other projects are planned or under design. The paper deals with technical solutions, environmental aspects, economy and potential for the different storage concepts. 7 refs., 5 figs., 1 tab.

36201 (ITL–8509, pp. 268-271) **System design for borehole heat stores, general aspects and operational experience from the store at Lulea, Sweden.** Nordell, B. (Lulea Univ. of Technology, Lulea, Sweden); Sehlberg, T.; Abyhammar, T. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Heat storing is not only a matter of heat capacity and losses. It is of great economical importance that charging and discharging can take place in a controlled, planned, and optimal way. In this paper the interface between the storage and the distribution system is analyzed generally and specifically for borehole stores. The design of and operational experience from the 2 GWh Lulea storage for industrial waste heat at 70^{0}C are presented. Discharge is carried out with a combined direct heat-exchanger and heat pump system operating in three modes. Heat is supplied to one large building with district heating back-up. Experience from two cycles, 1983-1985, is presented. 2 refs., 4 figs.

36202 (ITL–8509, pp. 279-283) **Capacity of saturated or unsaturated soil to restore calories by gelation.** Saix, C. (Lab. de Genie Civil, Montpellier, France); Jouanna, P. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The efficiency of off-season storage of solar energy in saturated or unsaturated soils may be greatly increased by the possibility of using such soils as a cold heat pump source below 0^{0}C. The attraction of this energy recovery form lies in the use of the latent heat of phase change of the water in the soil. However, there are still some unknowns concerning the soil types best suited to this process and possible risks or operational problems essentially related to the behavior of the soil in the vicinity of the heat exchanger. The parameters studied in laboratory and field experiments are: power and energy; range of soil temperatures; capillary suction in the soil; swelling or compaction at the soil surface; and cracking of the soil. The analysis of the experimental results; leading to a classification of soils studied in terms of their capacity to restore calories by gelation, depends essentially on examination of changes in the different parameters with time, in oreder to determine invariance or variance in energy recovery. 4 refs., 6 figs.

36203 (ITL–8509, pp. 284-289) **Thermal conductivity of rock and soil.** Sundberg, J. (Chalmers Univ. of Technology, Goeteborg, Sweden). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The thermal parameters of soil and rock have been examined for several years, in connection with projects using ground as a heat source or as an energy storage. In rock, about 3000 samples form the basis for an extensive statistical study of thermal conductivity for different rock types in Sweden. In soil, a large number of thermal conductivity measurements have been carried out in connection with determinations of water content, density, water retention curve, and for some samples also the mineral content. Diagrams for the thermal conductivity of different Swedish soil types have been established. 10 refs., 7 figs.

36204 (ITL–8509, pp. 337-340) **Cooling with ice. Canadian progress.** Morofsky, E. (Public Works Canada, Ottawa, ON, Canada). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A fully automated ice formation, storage, and utilization method has now been developed, using a layer-by-layer method of building an ice block from the bottom up and an energy extraction technique based on direct contact between water and ice. The system has been tested over several years and applied to both building cooling and to the chilling of vegetable crops. Evaluation of the cost-effectiveness of specific design applications is now underway. 17 refs.

36205 (ITL–8509, pp. 341-344) **Ice production using ambient winter temperatures.** Vigneault, C. (Engineering and Statistical Research Inst., Agriculture Canada, Ottawa, ON, Canada); Lemieux, M. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In 1982, Agriculture Canada undertook studies aimed at reintroducing the utilization of ice, wherever it proves economical, as a means of storing winter coldness. The ice-making system produces a block of ice by adding successive thin layers of water to the floor

of an insulated storage shed, and freezing them by cold outside air introduced via a ventilation system. An air distribution system has been developed as well as a water spray nozzle that satisfies all the requirements for the distribution of water in the production of ice by layers. An ice-level detector has also been developed to control the lift mechanisms for the air and water distribution systems. The average coefficient of performance value of the system was about 21, which is a substantial improvement over that of conventional refrigeration systems (2 to 4). 4 refs., 3 figs.

36206 (ITL–8509, pp. 375-395) **Seasonal storage of heat for district heating in Sweden.** Sabel, H. (The Swedish District Heating Association, Sweden). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

District heating has a relatively long tradition and is widely employed in Sweden. Since the end of the 1940s, district heating systems have been built in approximately 140 municipalities. New techniques, such as heat pumps, could easily be introduced into the district heating systems. Energy storage may be an attractive future alternative in the energy supply of the municipalities. This claim is based on the favourable experience of the demonstration plants built so far. This paper explains the following benefits of energy storage: the evening-out of the variations in load reduced investments; the utilisation of temporary surpluses of energy reduced fuel consumption; the creation of temporary heat drops increased electric power generation; and the utilisation today of the energy which is only available during the summer. 11 refs., 11 figs., 2 tabs.

36207 (ITL–8509, pp. 300-304) **Development of heat storage systems with vertical pipes in earth and rock.** Wilen, P. (Chalmers Univ. of Technology, Goeteborg, Sweden); Rhen, I.; Baeckstroem, B. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In the last ten years different methods for energy storage in the subsurface have been investigated. This study deals with heat storage systems with vertical boreholes or pipes (ducts) as heat exchangers in the ground. In Sweden these systems are today economical to use only in some cases, but if the investment cost can be reduced the demand for heat storage will increase. The aim of the project is to investigate the possible cost reductions that can be gained by developing the technique of heat storage constructions. Experience from fullscale projects and new construction ideas are considered. The study includes drilling methods and costs, properties of vertical heat exchangers, calculations of heat transfer, and economic considerations. 12 refs., 5 figs.

36208 (ITL–8509, pp. 307-315) **The "Fabrikaglace" process to make and store natural ice.** Buie, S. (Centre de recherche industriel du Quebec, Sainte-Foy, PQ, Canada). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This paper details the construction and use of a small shelter called "Fabrikaglace" that fabricates a block of ice during winter to be used for air conditioning in summer. The ice is formed due to an exchange of energy with the cold outside air brought in by a forced circulation system that distributes the air evenly over the surface of the ice. The city water is sprayed automatically as a function of the outside temperature by a motorized revolving sprinkler in a 2 mm thick layer. The air and water distribution systems are gradually raised as the ice grows to maintain a constant distance above the ice. The water distribution and the lifting mechanism are under microprocessor control based on accumulated degree minutes of freezing. Underneath a large scale "Fabrikaglace", a cold air circulation system is installed underneath the base slab and controlled to maintain the temperature between -1 to -4^{0}C. To transfer the reject heat from the air conditioning system to the block of ice, the melt water is used in open circuit piping along with a heat exchanger, a spraying device, and a circulating pump controlled by an aquastat immersed in the chilled water of the air conditioning system. 12 figs.

36209 (ITL–8509, pp. 316-320) **An annual storage ice system for summer cooling.** Francis, C.E. (Illinois State Univ., Normal, IL, USA). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The cold air of winter is used for producing relatively large amounts of ice in long-term underground storage. The stored cooling capacity of the ice is recovered during the following summer. Initial research indicates that in regions where the winter is sufficiently cold and of sufficient duration, this type of system could provide summer air conditioning, refrigeration, or process cooling. A water-saturated earth storage mass of 113 cubic meters was frozen after 589 hours of system operation beginning December 19, 1984. During the 1984 cooling recovery operation, the system ran for a total of 32 days. During this period, 2613 kWh were recovered with an estimated 5 to 8% of the stored cooling capacity remaining. However, all of the ice had been melted. 3 refs., 4 figs., 3 tabs.

36210 (ITL–8509, pp. 499-504) **Presentation of a software package for automated evaluation of soil heat storage projects.** Sauty, J.P. (Bureau de Recherches Geologiques et Minieres Orleans, France); Ausseur, J.Y. Intertask Ltd., Ottawa, ON (Canada). 1985. (In French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Bureau de Recherches Geologiques et Minieres (France) has been working for almost ten years in the field of soil heat storage by injection of hot water into an aquifer or by circulation of water in a closed loop in buried heat exchanger. With the benefit of this experience, the authors have compiled the various simplified formulas and charts in a publication soon to be completed. A computerized version of this manual is being prepared in 1985, used in conversational mode: the various climatic, thermal, hydraulic and financial parameters are requested of the user and default values are proposed. A description of the problems and decisions to be taken are clearly displayed on the screen at the appropriate mement. In output, the software displays the recovery rate of stored calories, the changes in energy levels and the thermal impact on the subsoil; coverage of surface requirements and evaluation of investments and operating costs appear opposite the quatities of energy conserved and transferred. Finally, this software package processes not only heat storage, but also direct use without thermal replenishment (heat pumps using ground water or soil-to-water heat pumps). 12 refs., 6 figs.

36211 (ITL–8509, pp. 494-498) **Energy storage by adsorption of water on zeolite for building heating.** Restuccia, G. (CNR Inst. for Transformation and Storage of Energy, Messina, Italy); Cacciola, G.; Recupero, V.; Di Leonardo, R. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In this paper, the possible applications for civil uses of a a machine based upon the adsorption/desorption process of water vapour on zeolite is discussed. The paper describes the design of a satisfactory heat transfer model with emphasis on the description of the shell and finned-tube heat exchanger located in the zeolite bed. A summary of work done on the plant assembly and the experimental results are given. Possible applications of the system to the civil sector are discussed. Zeolites are solids with very low thermal conductivity. heat transfer toward thermal source and load is the limiting factor for high specific power and economic feasibility of the system. The zeolite-water adsorption heat storage is a closed-loop cycle where the mass transfer depends upon the differential vapour pressure between the water and the zeolite so that there is little pressure drop due to the zeolite packed bed or to the plant configuration, reducing the problem created by mass transfer. 7 refs., 6 figs.

36212 (ITL–8509, pp. 490-493) **A HVAC system based on seasonal heat storage.** Oestensson, B. (Scandenergy, Nykoeping, Sweden). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In October 1984, a new heating, ventilation and air conditionig system was put into operation at Viberga supermarket in Finspong, Sweden. The system includes a heat storage where waste heat from freezers and from air conditioning is stored during summer. The storage consists of rock surrounding 24 drilled holes each of which is 110 m deep. The rock is heated to approximately 25^{0}C. In winter, the supermarket is heated with stored heat via a heat pump. Together with waste heat from freezers this heat covers 90% of the total heat demand of 1200 MWh. The last 10% is covered by a peak load oil burner. The system was built by SCANDENERGY on a purely commercial basis, with a pay off time for the investment of five years. This paper presents system design and experiences from construction and operation. 3 figs.

36213 (ITL–8509, pp. 485-489) **The borehole heat store at Lulea, Sweden.** Nordell, B. (Lulea Univ. of Technology, Lulea, Sweden). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In 1982-83, the first large-scale borehole heat store was constructed at Lulea University of Technology, Sweden. The main part of the seasonal heat storage system is a rock volulme of 100,000 m^3. The store is utilized for heating of one of the university buildings, with a heat demand of 2 GWh. This demand corresponds to the need of 100 one-family-houses in northern Sweden. The store is connected to the district heating system. The heat is produced by surplus gas from the local steel plant. During May to October the store is heated to 65^{0}C. During November to April the store is discharged, and the temperature is lowered to about 30^{0}C. The store has been in operation since July 1983. Heat input and output have varied considerably during the operation. When charging, the variations depend on temperature fluctuations in the district heating net. Heat output variations depend on a varying heat demand of the building. The operation of the heat store has been simulated by Hellstroem, Lund Institute of Technology. The calculated rock temperatures and the leaving water temperature were in good agreement with measured data. Other observations of importance are the bedrock up-lift as a consequence of thermal expansion. It was found that the maximum up-lift was 18 mm, compared to a theoretical value of 25 mm for a homogenous rock volume at actual temperature increase. The following subjects are dealt with in the paper: design and construction, research program, thermal functioning, and costs. 6 refs., 7 figs., 1 tab.

36214 (ITL–8509, pp. 480-484) **Storage of off-peak electrical energy in building floors with particular reference to resistance heating and heat pump systems.** Monaghan, P.F. (Univ. College, Galway, Ireland); O'Donnell, G.N. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This paper deals with storage of heat generated by off-peak electricity in concrete floors of buildings. Resistance heating cables and hot water piping are both considered. One- and two-dimensional finite difference models are used together with the ESP building energy simulation program to quantify the effects of: concrete thickness; position of heat generation cables or pipes; underfloor insulation; building thermal capacity; and floor coverings. Also considered are the effects of the off-peak charge period on energy storage, transient heat transfer to the building, concrete, cable and pipe temperatures, and heat loss to the ground. The major results are: both floor heating systems can provide adequate heat input to give recognized comfort levels in low energy buildings; and the parameters listed above can be manipulated to give different heat release cycles. In conclusion, the two off-peak electrical systems studied provide viable alternatives to conventional heating systems for low energy buildings. 8 refs., 7 figs.

36215 (ITL–8509, pp. 461-465) **Thermal energy storage in the energy ecosystem.** Hausz, W. (Eco-Energy Associates, Santa Barbara, CA, USA). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Thermal energy storage can reduce the cost of peaking equipment needed to produce, transport, and use each form of energy by matching the demand and supply for each energy form to reduce the peak output required, providing that the capital and operating costs of thermal energy storage are less than those of peaking equipment. Fuel costs may also be reduced when nuclear and coal fuels replace the alternative of using oil or gas. Thermal energy storage also facilitates serial use of energy when the several serial energy forms do not match in supply and demand. In late 1971, electric utilities faced increasing concern over increasing environmental problems and costs. Novel forms of energy generation, transport, storage, and use were evaluated to select promising technologies that should be developed. This project was the first to seriously suggest that aquifer thermal energy storage was a promising technology for seasonal storage. This paper is a resume and

re-appraisal of the role of thermal storage in these technologies and the potential benefits of their implementation. 11 refs., 2 figs.

36216 (ITL–8509, pp. 404-408) **Study of cool storage using refrigerant gas hydrate.** Akiya, T. (National Chemical Lab. for Industry, Yatabe, Ibaraki, Japan); Owa, M.; Nakaiwa, M.; Kawasaki, S.; Ishibashi, Y.; Ando, Y. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The aim of this study is to obtain basic data to develop a cool storage system that shifts the electrical demand for residential air-conditioning to off-peak period. At first, pressure-temperature phase diagrams of three refrigerant gas hydrates were determined. From the phase diagrams, the critical decomposition conditions and the heats of formation were calculated. Tests of formation-decomposition of gas hydrates were also carried out. From these test results it was found that the degree of supercooling for formation of hydrate depended on the previous heat treatment of the refrigerant-water mixtures. On the basis of these results, the cool storage system was designed conceptually. 11 refs., 11 figs., 2 tabs.

36217 (ITL–8509, pp. 426-431) **Analysis of a thermochemical energy storage system with liquid absorbents.** Bugaj, A.H. (Technical Univ. of Wroclaw, Wroclaw, Poland); Hahne, E. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This paper examines the use of liquid absorbents as a thermochemical storage medium. Parametric studies employed a model of simultaneous heat and mass transfer occuring in the system and an overall model of the system itself. During heat discharging operation the optimized energy turnover can easily exceed the value of 95%. The efficiency and energy storage density of the liquid absorbent/water system depends on the chosen operating concentrations of absorbent, which in turn depend on the input, output, charging, and discharging temperatures. Energy storage density ranges up to 1000 kJ/kg of solution. Charging operation of the particular system considered to the maximum concentration takes 200 hours with input energy being at 1000 kWh/ton of salt anhydrate. The useful heat energy extracted from the concentrated solution depends strongly on the temperature and humidity of discharging air stream. The practical energy storage density of the absorbent solution under the chosen conditions is 800 kWh/ton of salt anhydrate. 3 refs., 5 figs.

36218 (PNL–6797) **The aquifer chill storage project at the University of Alabama, Tuscaloosa: Progress report for 1985 and 1986.** Schaetzle, W.J.; Brett, C.E. Pacific Northwest Lab., Richland, WA (USA); Alabama Univ., University, AL (USA). May 1989. 75p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE89013764/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Aquifer thermal energy storage (ATES) is predicted to be the most cost-effective technology for seasonal storage of low-grade thermal energy. Approximately 60% of the US is underlain with aquifers potentially suitable for underground energy storage. Under sponsorship of the US Department of Energy (DOE), Pacific Northwest Laboratory (PNL), which is operated by Battelle Memorial Institute, has managed numerical modeling, laboratory studies, evaluation of environmental and institutional issues, and field testing of ATES at several sites. This report describes the monitoring and evaluation (under the auspices of PNL) of an ATES chill system constructed and operated by the University of Alabama at Tuscaloosa, Alabama. The system is the first such system to be monitored in a comprehensive manner. Results support both the promise and problems likely to be encountered in such systems. Chill ATES has the potential to substantially reduce energy consumption and, especially, summer peak cooling electrical demand. However, the geohydrologic environment that the system will use must be a major element in system design and operation. 9 refs., 25 figs., 10 tabs.

2509 Batteries

Refer also to citation(s) 36652

36219 (AD-A–204877/5/XAB) **Investigation of polymeric solid-electrolyte cells, carried out during a nominal three-year period, focused on the rechargeable lithium battery. Final report, 15 July 1985-30 October 1988.** Owens, B.B. Minnesota Univ., Minneapolis, MN (USA). Corrosion Research Center. 23 Jan 1989. 5p. Available from NTIS, PC A02/MF A01.

The present study investigated solid state secondary lithium cell systems, especially Li/PEO,$LiCF_3SO_3$/V_6O_{13}. The material necessary to fabricate thin film (100-200 micron) cells were characterized and the behavior of the cells was investigated as a function of cycle number, humidity, overcharge, temperature and rate. Cell performance looked promising with continued cycling. Results were reported in twenty-one technical publications.

36220 (AD-A–204965/8/XAB) **Introduction to lithium batteries. General document.** Garrard, W.N. Materials Research Labs., Ascot Vale (Australia). Sep 1988. 14p. (MRL-GD–0018). Available from NTIS, PC A03/MF A01.

Lithium batteries are being introduced into all three services in the Australian Defence Force. However, general information concerning lithium batteries is not available in a condensed form. This review examines various aspects of lithium batteries, including battery technology, safety aspects, purchasing, packaging, transport, storage, and disposal.

36221 (CONF-8905175–1) **Accelerated life evaluation of valve-regulated lead-acid batteries.** DeLuca, W.H.; Miller, J.F. Argonne National Lab., IL (USA). 1989. 9p. Sponsored by EPRI;OUS. DOE Contract W-31109-ENG-38. From International lead-acid zinc research seminar; Orlando, FL, USA; 4-5 May 1989. Order Number DE89012429/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Valve-regulated lead-acid (VRLA) batteries are primarily used in standby and uninterruptable power source applications at present. Manufacturers expect these and/or similar VRLA batteries to provide a life of 1000–1500 cycles with deep discharging at operating temperatures of ~25°C. However, insufficient data are available to determine their suitability and life in such repetitive cycling applications. Argonne National Laboratory (ANL) has developed and initiated an accelerated life evaluation of VRLA batteries to acquire this data. The objectives of the ANL accelerated life evaluation are (1) to use accelerated testing techniques to obtain supporting evidence within 6 months that VRLA batteries have an expected life of more than 500 cycles in deep-discharge applications, and (2) to determine VRLA battery life within a 2–3 year time period under conditions (temperature and depth-of-discharge) that simulate those encountered in a utility operating environment. 3 tabs.

36222 (PB–89-166771/XAB) **Electrode-induced beta battery degradation. Final report.** Roberts, R.; Browall, K.W. General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center. Nov 1983. 37p. Available from NTIS, PC A03/MF A01.

This report describes an investigation of sodium and sulfur electrode effects on beta-alumina ceramic electrolyte degradation. Specifically, four aspects were examined: (1) sulfur-electrode resistance contribution to overall cell resistance over time; (2) effects of calcium and potassium impurities in the sodium electrode on performance and cell life; (3) effect of air contamination on cell performance; and (4) evaluation of the sulfur electrode's chemical corrosivity on the ceramic. Calcium levels in excess of several hundred ppm led to severe pitting of the beta-ceramic. Addition of dry oxygen to the sodium compartment led to sodium oxide formation and a reduction in cell capacity, while wet oxygen introduction

caused rapid deterioration in cell performance and life. Dry nitrogen addition to the sodium compartment had no effect on either performance or resistance, while wet nitrogen had an effect similar to wet oxygen. Finally, it was found that preferential cycling in either the one- or two-phase region had no influence on beta-alumina surface degradation.

36223 **Electrode materials and processes for energy conversion and storage.** Srinivasan, S.; Wagner, S.; Wroblowa, H. 628p. The Electrochemical Society, Pennington, NJ (1987). (CONF-8705216–: 2. symposium on electrode materials and processes for energy conversion and storage, Philadelphia, PA, USA, 11-15 May 1987).

This book contains 47 selections. Some of the titles are: Towards new materials in energy conversion; Monte Carlo simulation of the electrochemical faceting mechanism; Alternating current electrolysis at semiconductor electrodes; Materials for fuel cells, 1977-1997; Analysis and interpretation of AC impedance data for porous electrodes; and Fuel cells for extraterrestrial and terrestrial applications.

29 ENERGY PLANNING AND POLICY

36224 (HQ–1988-VA) **Hydro-Quebec development plan, 1988-1990. 1997 outlook. Abridged version.** Hydro-Quebec, Montreal (Canada). 1988. 43p. (In French). (MICROLOG–89-01196). Available from Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, Canada H2Z 1A4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Hydro-Quebec, a Crown corporation incorporated in 1944, provides Quebec with electric power. It has 19,000 employees and $31 billion worth of assets. Its 80 power plants have a total capacity of 24.5 GW. In 1987, it sold 153 billion kWh of electricity, including 29 billion outside Quebec. This report is aimed at the shareholders, the main partners, and the employees of Hydro-Quebec, which defines the orientations, objectives, and strategies of the company. It deals with the coming ten years, but mainly with the decisions to be made during the next three years. The report summarizes the recovery measures of recent years, and discusses the condition of Quebec and external markets, the operation and development of installations, the management of human resources, the development of new technologies, and financial management. Also discussed are the interactions between the various strategies of Hydro-Quebec and the impacts of the company's activities on its partners and on the community. 12 figs., 12 tabs.

36225 (HQ–1988-VI) **Hydro-Quebec development plan, 1988-1990. 1997 outlook. Full-length version.** Hydro-Quebec, Montreal (Canada). 1988. 151p. (In French). (MICROLOG–89-01196). Available from Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, Canada H2Z 1A4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This plan is aimed at the shareholders, the main partners, and the employees of Hydro-Quebec. It defines the orientations, objectives, and strategies of the company and is intended to encourage co-operation for the beneficiation of hydroelectric energy in Quebec. Though it covers a 10-year span, the plan concentrates on the actions to be undertaken during the first three years, including the strengthening of the recovery actions that began in 1982. The objectives and strategies are essentially the same as in the previous plan. As previously, several scenarios of development have been considered. The uncertainties of the future of the economy, of the exchange rates of the Canadian dollar, and of petroleum prices illustrate the risks involved. The report first draws up a summary of the actions of the last years and of the "external context". It then discusses the marketing actions on Quebec markets and the resulting target of electricity demand, the strategies of external markets development, and the operation and development of installations. It gives an account of Hydro-Quebec's prospects in the fields of technology development and international affairs. It discusses human resource and financial management, especially the financial framework of the years 1988-1990. Finally, the report discusses the impacts of the considered strategies on Hydro-Quebec's partners. 33 figs., 35 tabs.

2901 Energy Analysis and Modeling

Refer also to citation(s) 36229, 36231, 36263, 36264, 36265, 36267, 36268, 36274, 36393

36226 (PNL–6920) **Review of second law analysis techniques applicable to the Energy Conversion and Utilization Technologies Thermal Sciences Program.** Drost, M.K.; Zaworski, J.R. Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 30p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE89014580/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes a review of second law analysis emphasizing techniques applicable to basic research in the thermal sciences. Second law analysis is a class of thermodynamic analysis techniques that has become increasingly popular in the design of thermal systems. Pacific Northwest Laboratory conducted this review in 1987 for the US Department of Energy's (DOE) Energy Conversion and Utilization Technologies (ECUT) Program. The primary goal is to determine whether second law techniques can be used in guiding or contributing to basic research in the thermal sciences. 35 refs.

36227 (STC/SA–11) **Energy analysis of Canadian external trade, 1971 and 1976.** Hamilton, K.E. Statistics Canada, Ottawa, ON (Canada). Structural Analysis Div. 1988. 46p. (In English and French). (MICROLOG–89-02307). Available from Statistics Canada, Library, R.H. Coates Bldg., Tunney's Pasture, Ottawa, ON, Canada K1A 0T6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Methodology and results are presented to show that Canadian exports (dominated by raw and semi-finished goods) were significantly more energy intensive than imports (dominated by manufactured goods) in both 1971 and 1976. The net surplus of export energy requirements over import energy requirements totaled 9% of domestic use of energy in 1971. Canadian intensiveness of energy use, as measured by the aggregate energy/GDP ratio, changed little over this period. Decomposition of commercial energy requirements per dollar of GDP reveals that final consumption patterns and direct energy use coefficients (the use of energy per constant dollar of production in each commercial sector) moved in the direction of increased energy intensity between 1971 and 1976; these effects were largely counteracted by shifts in the pattern of trade. 10 refs., 1 fig., 8 tabs.

2902 Economics and Sociology

Refer also to citation(s) 35656, 35864, 36238, 36246, 36255, 36256, 36258, 36274, 36379, 36392

36228 (DEA–1989) **Canada's new free trade agreement. Energy.** Department of External Affairs, Ottawa, ON (Canada). [1989]. 8p. (In English and French). (MICROLOG–88-01806). Available from Canada Dept. of External Affairs, Lester B. Pearson Bldg., 125 Sussex Dr., Ottawa, ON, Canada K1A 0G2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This pamphlet presents a brief overview of the economic impact of the energy industry in 1985, the future interaction between Canada and the United States under the Free Trade Agreement, and the methods used to deal with shortages, if they develop. It also addresses energy sovereignty, and the regional and national advantages of the agreement to the energy industry.

36229 (MU/ES–EC88-01) **General economic stimulation and energy indicators for capital investment initiatives in various transportation modes.** Allen, B.L.; Butterfield, D.W.; Kliman, M.L.; Kubursi, A.A.; Welland, J.D.; Kazakov, A. McMaster Univ., Hamilton, ON (Canada). Inst. for Energy Studies. 1988. 122p. (MICROLOG–89-02354). Available from Ont. Min. of Transportation and Communications, R & D Branch, 1201 Wilson Ave.,

Downsview, ON, Canada M3M 1J8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

While capital spending by the Ontario Ministry of Transportation provides new and expanded transportation services and aids in maintaining the quality of the services already provided, it also has as secondary effects the generation of tax revenue and employment, the use of energy resources, and the production of income, both inside and outside the province. This report describes the development of a Transport Impact Model (TRIM), a comprehensive analytical tool to provide the Ministry with indicators of the secondary effects of its programs. TRIM is a self-contained, user-friendly program that runs on any IBM-compatible personal computer. The present version views the impacts of 35 pre-defined typical projects, either individually or in combination; provides adjustments of the assumptions made; and enables the user to insert specially defined projects. A given spending project is evaluated via a list of the goods and services that will be used in the project; this is entered into the model, which then calculates the effects of the project expenditures on a series of variables relating to the Ontario economy. The report also describes the thinking behind the model, sets out the variables that are calculated as indicators, and describes how the data that define a simulated project are constructed and entered into the model. Examples of the application of the model are also presented. The relationship between TRIM and MIES (Micro-Economic Impact Evaluation System), an earlier model, is also given. 15 tabs.

36230 (OME–1988, pp. 9) **Transferring technology. A social marketing perspective.** Lalungpa, S.D. (Passmore Associates International). Ontario Ministry of Energy, Toronto, ON (Canada). 1988. (CONF-880711–: Small hydro '88: international conference and trade show, Toronto, Canada, 4-9 Jul 1988;MICROLOG–89-02657;CE–02581). In *Small hydro '88. An international conference and trade show. Proceedings, vol. 2.* Available from Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Given that small hydro offers itself as a small, community friendly, environmentally benign technology with considerable possibilities for decentralization, it may be useful to tap the body of knowledge and experience now available on development and technological transfer. The ideological basis for modernization has often been an enlightened paternalism, with development priorities set by donor organizations or central governments with little regard for the communities affected. The realization that the tools of marketing could be used to promote socially desirable ends is now defined as social marketing. According to Kotter, social marketing utilizes the concepts of market segmentation, consumer research, idea configuration, communication, facilitation incentives and exchange theory to maximize target response. Participation is recommended as promoting the triad of efficiency, equity and enprowerment.

36231 (SC/SES–23F) **Energy typologies. Energy expenditures of Canadians, 1969-1982.** Heslop, L.A. Statistics Canada, Ottawa, ON (Canada). Social and Economical Studies Div. 1986. 62p. (In French). (MICROLOG–89-02446). Available from Statistics Canada, Library, R.H. Coates Bldg., Tunney's Pasture, Ottawa, ON, Canada K1A 0T6; $5.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In order to deal with energy use patterns and lifestyles as a set of consumption decisions, an energy typology matrix was developed by dividing in-home and gasoline energy expenditures into high, medium and low levels. Data from the 6 Family Expenditure Surveys from 1969-82 are used to study the lifestyles of the occupants in each of 9 energy expenditure cells. These cells incorporate both expenditure categories and demographic characteristics. Further analysis of energy expenditures on a per capita, a per room and per room per 1000 degree day basis, and an analysis of insulation expenditures, provide information on the nature of energy expenditure increases and efforts to restrain them. The sample included only full-year households who were owners and renters of houses - detached, semi-detached, row, town - and who made payments directly for their energy. Energy conservation efforts are most evident among those with higher education levels and higher energy use levels. However, those with more limited resources have experienced larger relative increases in energy expenditures. 2 refs., 10 tabs

2903 Environment, Health, and Safety

Refer also to citation(s) 35565, 35741, 35782, 35783, 35884, 35885, 35886, 35888, 35889, 35891, 35892, 35893, 35894, 35956, 36145, 36146, 36258, 36433, 36435, 36436, 36437, 37181, 37199, 37205, 37220, 37280, 37281, 37399

36232 (EPS–1988) **Reporting for the domestic substances list.** Environment Canada, Ottawa, ON (Canada). Environmental Protection Service. 1988. 111p. (In French). (MICROLOG–89-00931). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Within the framework of the "from cradle to grave" method of managing toxic substances, the provisions of the Canadian Environmental Protection Act pertaining to substances that are new in Canada ensure that no new toxic substance shall be introduced on the Canadian market before an assessment of its toxicity has been made by the appropriate ministries. For this purpose are established an interior list of substances, as well as an exterior list of substances that are used for commercial purposes in the rest of the world, though not yet in Canada. This report indicates which substances are to be declared, how to declare them, and what information is to be provided, in particular, place of manufacture and types of uses (fuel, fuel additive, etc). The report also lists the available documentary sources and discusses the questions pertaining to the confidentiality of the chemical formulation of a product. Appendices give a glossary of terms and a 7-page list of the most common chemical groups. 5 tabs.

36233 (UCRL–21175) **Lawrence Livermore National Laboratories Environmental Protection Department 1988 California legislative highlights.** Kahl Associates, Sacramento, CA (USA). Mar 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89014806/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report contains a summary of state legislative activity that might impact on the environmental activities of the Lawrence Livermore National Laboratory. Topics include air quality, hazardous materials handling, liability, fees, and various legislative proposals. (TEM)

2904 Natural Resources

Refer also to citation(s) 36228, 36433, 37280

36234 (AE–1-252) **Alberta's energy and mineral resources.** Alberta Energy, Edmonton, AB (Canada). [1989]. 19p. (MICROLOG–89-02077). Available from Alberta. Dept. of Energy, Information Centre, Petroleum Plaza Tower, 9915-108 St., Edmonton, AB, Canada T5K 2C9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This booklet outlines briefly the history, nature, and scope of conventional crude oil, heavy oil, oil sands, natural gas, coal, and other minerals, as well as the principles of resource management. Also included are a glossary of terms and significant dates in the development of the province's energy resources. 2 figs.

36235 (EC–1988) **Perspectives on land modelling. Workshop proceedings.** Gelinas, R. (ed.); Bond, D. (ed.); Smit, B. (ed.). Environment Canada, Ottawa, ON (Canada). 1988. 244p. (CONF-8611291–: Perspectives on land modelling, Toronto, Canada, 17-20 Nov 1986;MICROLOG–88-06350). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A workshop was held to facilitate an exchange of information on the use of land modelling and the development of new modelling techniques, and to review progress in the field to date. A series of presentations on models in land resource planning and management stressed an integrated modelling approach. Presentations that concerned modelling the effects of climate change on the land resource base tended to focus on future trends and possibilities, while some presentations in the field of acid deposition impact assessment demonstrated how models can be used to fill information gaps and help understand what is occurring. Other areas covered included temporal and spatial models for natural resource management; land modelling applications; and priority issues, methods, and applications. Separate abstracts have been prepared for four papers from this workshop.

36236 (LA-UR–89-1605) **Central American resource studies.** Van Eeckhout, E.; Laughlin, A.W. Los Alamos National Lab., NM (USA). 1989. 12p. DOE Contract W-7405-ENG-36. (CONF-8903135–2: Costa Rica symposium, San Jose, Costa Rica, 6-9 Mar 1989). Order Number DE89012616/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Los Alamos National Laboratory has been working with five Central American countries to assist in the development of their energy and mineral resources. Since 1985, mineral resources in Costa Rica, peat resources in Costa Rica and Panama, geothermal energy resources in Honduras and Guatemala, and geothermal field development in El Salvador and Costa Rica have been topics of study. This paper presents an overview of this work – within these proceedings are papers that deal with specific aspects of each topic, and these will be duly noted. 15 refs., 4 figs.

36237 (PB–89-168462/XAB) **Potential supply of minerals from the White Mountains National Recreation Area and Part of the North Steese National Conservation Area Alaska. Appendix A- potential mineral supply analysis methodology.** White, B.A.; Gunther, T.M.; Johnson, R.; Adams, R.L. Bureau of Mines, Washington, DC (USA). Feb 1989. 376p. (BUMINES-OFR–12-89). Available from NTIS, PC A17/MF A01.

This report combines geologic, engineering, and economic analysis to estimate the quantity and value of minerals in undiscovered deposits in the White Mountains National Recreation Area and the Steese National Conservation Area in Alaska. The study was performed at the request of the Steese-White Mountains District Office, Bureau of Land Management, and will be used in a re-evaluation of current Resource Management Plans (RMP's). It was prepared by the Bureau of Mines, with geologic assessments from the U.S. Geological Survey, the Alaska Division of Geological and Geophysical Surveys, and the Bureau of Mines. The current RMP's restrict or prohibit access to eight types of mineral deposits. At mid-1987 prices, the effect of the RMP's is to reduce the expected quantity of gold produced by 112,000 ounces, with a market value of $50 million.

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 35522, 35633, 35667, 35690, 35692, 35721, 35909, 35925, 36198, 36200, 36204, 36206, 36252, 36908, 36912, 37395, 37821

36238 (ACERR–1989) **Alberta/Canada Energy Resources Research Fund annual review, 1987-1988.** Alberta/Canada Energy Resources Research Fund, Edmonton, AB (Canada). 1989. 40p. (In English and French). (MICROLOG–89-02997;CE–02590). Available from Alberta Energy and Natural Resources, Information Centre, 9920-108 St., Edmonton, AB, Canada T5K 2M4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Alberta/Canada Energy Resources Research Fund was created in 1976 between the governments of Alberta and Canada to promote and support the development and efficient use of Alberta's existing and potential energy resources to meet the province's and Canada's medium- and long-term energy needs; and to encourage the development of scientific and technical expertise in energy research, development and demonstration in Alberta. The program includes the production, transportation, conservation and utilization of both renewable and nonrenewable (fossil fuel) resources, generally excluding oil sands and heavy crude oil. This review highlights the research activities undertaken during the year. These include recovery of waste heat produced by the refrigeration system of a cattle-slaughtering and meat-packing operation, resulting in a payback period of only 15 months and substantial cost savings; installation of a heat recovery and water recycling system in two Calgary launderies, causing natural gas use to decline by up to 50%; the use of coal rather than natural gas as a fuel in steam operations in several oil sand/heavy oil regions of Alberta; and research programs at the Coal Research Centre at Devon, Alberta, the principal centre for coal research in Western Canada. A financial statement is included.

36239 (CANMET–87-8) **CANMET review 1986-1987.** Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). 1988. 151p. (In English and French). (MICROLOG–89-01008). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Canada Centre for Mineral and Energy Technology conducts and supports research and development in the fields of mining and processing of minerals, coal, and oil sands, and their utilization. Technology transfer, information services, and support services are also part of the Centre's activities. This report reviews activities related to mining in general, coal and oil sands mining and preparation, mineral processing, fuels technology (including bitumen and heavy oil recovery, upgrading, and conversion of energy sources such as coal, natural gas, and biomass), and metals and materials. 14 figs., 1 tab.

36240 (CANMET–SP88-19) **CANMET Catalogue of publications, 1984/1985.** Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). 1988. 95p. (In English and French). (MICROLOG–89-00959). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A comprehensive listing is provided of a total of 735 reports, journal articles, texts of oral presentations, and monographs related to research done or contracted by the Canadian Centre for Mineral and Energy Technology (CANMET) during 1984/85. The list is arranged into sections including CANMET reports, contract reports, and reports of CANMET divisions: Coal Research Laboratories, Energy Research Laboratories, Mining Research Laboratories, Mineral Sciences Laboratories, Office of Technology Transfer, and Physical Metallurgy Research Laboratories. Indexes are provided of authors, contractors, and subjects.

36241 (CONF-890659–1) **Negotiating a license to government technology.** Soderstrom, E.J. Oak Ridge National Lab., TN (USA). 1989. 10p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 14. annual meeting and international symposium of the Technology Transfer Society; Oak Ridge, Tennessee, USA; 13-16 Jun 1989. Order Number DE89014770/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper discusses reasons and methods for the commercialization of government research programs. Also covered are ideas expressing why a competitive edge is necessary for the USA in the world market place. (JEF)

36242 (CONF-890659–2) **Marketing for Oak Ridge technology transfer.** Prosser, G.A. Oak Ridge National Lab., TN (USA). 15 Jun 1989. 14p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 14. annual meeting and international symposium of the Technology Transfer Society; Oak Ridge, Tennessee, USA; 13-16 Jun 1989. Order Number DE89014766/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Martin Marietta Energy Systems, Inc., which manages major research and production facilities in Oak Ridge, Tennessee for the Department of Energy, has implemented a systematic approach to marketing for technology transfer. Unique mechanisms have been

created to address the need for market research and analysis, strategy formulation, and the execution of plans designed to engender the broadest commercial use of government-funded technologies. Establishment of formal ties with the University of Tennessee Graduate School of Business has resulted in an expanded role for marketing in support of the Oak Ridge program. The creation of graduate research positions has enabled MBA students to contribute to, and learn from, a program which is at the forefront of an important national initiative.

36243 (ITL–8509, pp. 396-403) **Heat storage R&D in The Netherlands.** van Mourik, G.J. (Management Office for Energy Research, Utrecht, The Netherlands). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Recently, the management structure of the R&D programs on energy conservation and renewables in The Netherlands has been changed. At present, a new-founded management office is responsible for all R&D programs. Energy storage is part of the geothermal energy and energy storage program. A detailed program to develop heat storage in aqifers is presently being undertaken. This paper discusses program funding and cost goals. 1 tab.

36244 (NRC–9014514) **Frontiers in chemical engineering: Research needs and opportunities.** National Research Council, Washington, DC (USA). Committee on Chemical Engineering Frontiers-Research Needs and Opportunities. 1989. 219p. Sponsored by DOE Fossil Energy. DOE Contract FG01-85FE60847. Order Number DE89014514/JAW. Available from NTIS, PC A11/MF A01 - OSTI; GPO Dep.

This report demonstrates that chemical engineering research will continue to address the technological problems most important to the nation. In the chapters that focus on these problems, many of the discipline's core research areas (e.g., reaction engineering, separations, process design, and control) will appear again and again. The committee hopes that by discussing research frontiers in the context of applications, it will illustrate both the intellectual excitement and the practical importance of chemical engineering. The research frontiers discussed in this report can be grouped under four overlapping themes: starting new technologies, maintaining leadership in established technologies, protecting and improving the environment, and developing systematic knowledge and generic tools.

36245 (ORNL–6541/V1) **Energy technology R and D: What could make a difference?: A study by the staff of the Oak Ridge National Laboratory: Part 1, Synthesis report: Volume 1.** Fulkerson, W.; Auerbach, S.I.; Crane, A.T.; Kash, D.E.; Perry, A.M.; Reister, D.B.; Hagan, C.W. Jr. (ed.). Oak Ridge National Lab., TN (USA). May 1989. 184p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014568/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The objective of this study was to survey both energy technologies and crosscutting areas of science and technology in order to identify important R and D needs and opportunities in the context of the US and world energy situations. The imperative for R and D was judged against its potential for fixing current energy system problems; for providing a robust set of options for coping with, taking advantage of, or encouraging future energy circumstances; and for creating unanticipated opportunities. 103 refs., 36 figs., 22 tabs.

36246 Providing incentives for effective technology transfer. Soderstrom, E.J. (Martin Marietta Energy Systems, Inc. Oak Ridge, TN (USA)); Prosser, G.A. *Forum for Applied Research and Public Policy (Knoxville, Tennessee)(USA),* 3(4): 6-14 (Win 1988).

Historically, attempts to transfer technology from the public to private sector have not worked well because individuals and institutions have not been motivated to make it work. While legislative acts and presidential decrees have created a more favorable legal/political environment, government research institutions must take initiatives to transform the intent of such actions into reality. Such initiatives must recognize that technology transfer is not a unidirectional transaction, but an exchange between two parties-one that enables each to benefit or profit. To motivate properly, the profit incentive must produce a tangible return on the investments made by both parties. Such an approach is consonant with the profit motive that undergirds the US economy. It is the basis for a technology-transfer program implemented by Martin Marietta Energy Systems, Inc. (Energy Systems), which manages and operates major research and production facilities in Oak Ridge, Tennessee, for the US Department of Energy. 22 references.

2906 Nuclear Energy

Refer also to citation(s) 36048, 36049, 36064, 36145, 36146

36247 (Juel-Spez–479) **Non-proliferation regime, vertical proliferation and the interests of the Federal Republic of Germany.** Fischer, W. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Technik und Gesellschaft; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Forschungsgruppe Wirtschaft, Energie, Investitionen. Dec 1988. 171p. (In German). Order Number DE89788286/JAW. Available from NTIS (US Sales Only), PC A08/MF A01.

The disarmament orientation of the NPT, which stands beside the central aim of avoiding horizontal proliferation, raises a question: Does a compatibility exist between the non-proliferation policy of the Federal Republic and its security policy, which has its basic pillar in the nuclear deterrence strategy? Critics of this deterrence policy therefore, hinting to the disarmament determination of the NPT, demand that the Federal Republic should exercise its influence for the conclusion of a 'Comprehensive Test Ban Treaty' (CTBT), the establishment of a 'Nuclear-Weapons-Free-Zones' (NWFZ) in Europe, a 'No First Use'-Treaty (NFU) and finally the abolishment of all atomic weapons ('Zero Solution'). According to them such disarmament 'remedies' can reestablish or assure the waning or damaged international consensus for horizontal non-proliferation. This is a contribution for the establishment of a stable world order and will smooth the way for a prolongation of the NPT in the year 1995. An analysis of the history and the structure of interests shows that the policy of the Federal Republic of Germany is deeply rooted in the NPT and that a prolongation of the treaty and its own membership is a substantial object of the foreign and security policy. Consequently the Federal Republic has to face the demands for an intensification of 'anti-nuclear measures' and has to examine their acceptability and their usefulness with respect to non-proliferation. The structure of the problem encloses the following aspects: The security conception of the Federal Republic with its military-strategic essence; the provisions in article VI NPT for negotiations with the object of a world free of atomic weapons; the derived disarmament 'remedies' for strengthening the consensus for horizontal non-proliferation and, finally, the real interface between horizontal and vertical proliferation.

36248 (LBL-PUB–625-Vol.1) **Journal of Glenn T. Seaborg, Chairman of the US Atomic Energy Commission, 1961–1971: Volume 1, February 1, 1961–June 30, 1961.** Seaborg, G.T. Lawrence Berkeley Lab., CA (USA). c Jan 1989. 529p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. Available from Glenn T. Seaborg, Lawrence Berkeley Lab., Mail Stop 70-A-3307, 1 Cyclotron Rd., Berkeley, CA 94720.

This introduction to my journal of 1961–1971, covering my years of service as Chairman of the US Atomic Energy Commission, is written from the perspective of 1971, in order to reflect the attitudes expressed in my journal, which was written on a daily basis during that period. Thus, I express the points of view of that time rather than those of today (1988), which might occasionally be somewhat different. The journal consists of 25 volumes, averaging 700 pages each. This comprises about 15,000 items consisting of the approximately 4000 daily entries and the average of about three attachments per day. The journal has three sections corresponding to each of the three presidents I served as chairman of the Atomic Energy Commission – the first six volumes covering the John F. Kennedy years (February 1, 1961–November 22, 1963), the next 11

volumes covering the Lyndon B. Johnson years (November 22, 1963–January 20, 1969) and the final eight volumes, the Richard M. Nixon years and a few months of post-AEC chairman activities in Washington (January 20, 1969–November 6, 1971.)

36249 (LBL-PUB–625-Vol.2) **Journal of Glenn T. Seaborg (Chairman, US Atomic Energy Commission, 1961 through 1971), July 1, 1961–December 31, 1961.** Seaborg, G.T. Lawrence Berkeley Lab., CA (USA). c Jan 1989. 519p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. Available from Glenn T. Seaborg, Lawrence Berkeley Lab., Mailstop 70-A-3307, 1 Cyclotron Rd., Berkeley, CA 94720.

This introduction to my journal of 1961–1971, covering my years of service as Chairman of the US Atomic Energy Commission, is written from the perspective of 1971, in order to reflect the attitudes expressed in my journal, which was written on a daily basis during that period. Thus, I express the points of view of that time rather than those of today (1988), which might occasionally be somewhat different. The journal consists of 25 volumes, averaging 700 pages each. This comprises about 15,000 items consisting of the approximately 4,000 daily journal entries and the average of about three attachments per day. The journal has three sections corresponding to each of the three presidents I served as chairman of the Atomic Energy Commission – the first six volumes covering the John F. Kennedy years (February 1, 1961–November 22, 1963), the next 11 volumes covering the Lyndon B. Johnson years (November 22, 1963–January 20, 1969) and the final eight volumes, the Richard M. Nixon years and a few months of post-AEC chairman activities in Washington (January 20, 1969–November 6, 1971).

2908 Waste Heat Utilization

Refer also to citation(s) 35953, 36323, 36325

36250 (EPRI-CU–6332, pp. 8.1-8.17) **Cogeneration in Europe.** van den Berg, J.M. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Cogeneration is an interesting issue. Nearly all over the world, organizations in the electric power sector are concerned with aspects of cogeneration. Governments and regulators pay a great deal of attention to cogeneration, and as a consequence of the wishes and requirements of the governments, the electric utilities are involved in the issue as well. Nevertheless, the share of self-generation and cogeneration in electricity production is declining all over Europe, except in the Netherlands. The expectations for Europe are not very optimistic. As the combined production of heat and power can be an important long-term energy saving option, it is paradoxical that the prospects of introducing more cogeneration are so limited. Actually, these prospects are quite different for the various countries, and largely depend on the typical situation in each country. The possibilities for cogeneration to compete with the public sector are discussed.

36251 (EPRI-CU–6332, pp. 9.1-9.12) **Development of and outlook for cogeneration in the United States.** Gransell, H. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

During the past decade, installation of cogeneration systems and other small power production facilities has increased rapidly in the United States. One significant piece of legislation, the Public Utility Regulatory Policies Act of 1978 (PURPA), had a tremendous impact on the development of this market. Through the federal government, PURPA mandated that electric utilities must purchase the energy produced from these cogenerators and small power producers at prices equal to their own avoided costs. In addition, PURPA removed several regulatory and institutional obstacles to developing cogeneration and small-power production, and provided economic incentives for equipment investment. As a result of PURPA, it became economically feasible for some commercial and industrial customers to generate electricity to meet their own needs, and where avoided costs are high, even sell electricity to local utilities. Most of the cogeneration (and small power production) projects implemented as a result of PURPA produce high thermal loads, which are very efficient and generally quite profitable. In some areas of the country, however, a different strategy has been adopted - one that takes advantage of utilities' high avoided costs. In these areas, cogeneration facilities that maximize electricity sales to utilities have been designed and implemented. These are often known as PURPA machines. The development of cogeneration facilities in the USA is discussed.

2910 Conservation

Refer also to citation(s) 36407, 36408

36252 (AD-A–205051/6/XAB) **Technology selection criteria and methodology for prioritizing energy research and development programs. Final report.** Windingland, L.M.; Teagan, P.; Frantzis, L. Army Construction Engineering Research Lab., Champaign, IL (USA). Jan 1989. 40p. (CERL-TR-E–89/06). Available from NTIS, PC A03/MF A01.

The U.S. Army Construction Engineering Research Laboratory (USACERL) has conducted an investigation into the development of an optimal strategy for selecting and prioritizing energy research and development (R&D) projects. This work is part of an ongoing effort to ensure that USACERL's R&D program includes an appropriate combination of new technologies for both short and longer term return on investment. The R&D goal is to provide the Army with the most-effective equipment and processes for conserving energy. Energy R&D work being conducted by various Governmental and private firms was reviewed and the methodologies for selection and prioritization of projects were analyzed. The processes require making judgments on key issues such as: probability of achieving performance goals; probable cost structures; commercial interest; status of competing technologies; and potential application of the technology. The existing approach taken at USACERL was compared with project selection methods of other Government and private organizations. Recommendations were developed for improving the selection criteria and methodology at USACERL.

36253 (DOE/IR/05106–T52) **Energy Task Force status report for first quarter year ten.** Urban Consortium for Technology Initiatives (USA). Energy Task Force. 1989. 152p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG02-78IR05106. Order Number DE89014845/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

This group of papers from the Urban Consortium Energy Task Force includes the following topics: community and economic development; energy and waste management; renewable energy sources; and alternate fuels for vehicles. (JEF)

36254 (DOE/IR/05106–T81) **Computer-assisted control for municipal water systems: Phase II, Implementation of a computer-assisted energy management program.** Lederer, C.C.; Thomas, A.H.; Davanzo, A.C. Urban Consortium for Technology Initiatives (USA). Energy Task Force. Jul 1988. 59p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG02-78IR05106. Order Number DE89013845/JAW. Available from NTIS, PC A04/MF A01 - OSTI.

This Phase II report will provide valuable input to both the Computer Control and Operation and Maintenance Manual projects in the areas of energy efficiency as it relates to the water distribution system. Based on examination of the current water distribution system layout, high lift pumping equipment performance and system control capabilities, three potential strategies for implementing energy conservation measures through computer assisted control were identified in the Phase I report. These strategies included preferential pump operation, redistribution of pressure districts and reduction of peak electrical demands.

36255 (NOVA–1989) **Community energy planner.** Diamond, L.; Cole, R.J.; Cooper, K.; Millbank, N. Nova, an Alberta Corp., AB (Canada). [1989]. 131p. (CE–02650). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $ PRICES UPON REQUEST, FUNDS CAN.

This guide was written to help those who live in Canada's remote communities beyond a hydroelectric grid or natural gas line. The guide gives information on organizing for an energy plan; auditing the community for heat and electricity use; assessing available energy alternatives; and designing, installing, and operating the chosen energy systems. Case studies of various types of communities are included. Methods of measuring head and streamflow for small hydro installations are given, as well as solar and wind data. Suggested alternatives include the use of wood heat, passive solar heating, solar water heating, and the generation of electricity using small scale hydro installations, wind power, and photovoltaic installations.

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 35651, 35682, 36236, 36340

36256 (DOE/EIA–0527(89)) **Assumptions for the annual energy outlook 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 23 Jun 1989. 51p. Sponsored by DOE Management & Administration. Order Number DE89014111/JAW. Available from NTIS, PC A04/MF A01 - GPO - OSTI; GPO Dep.

The purpose of this report is to present important quantitative assumptions, including world oil prices and macroeconomic growth, underlying the AEO forecasts. The report has been prepared in response to external requests, as well as analyst requirements for background information on the AEO and studies based on the AEO forecasts. 16 tabs.

36257 (EPRI-CU–6400) **Information and automation technology: Serving electric utility customers in the 1990s: Conference proceedings.** Electric Power Research Inst., Palo Alto, CA (USA); Policy Research Associates, Inc., Reston, VA (USA). c Jun 1989. 532p. Sponsored by Electric Power Research Institute. (CONF-881294–: Information and automation technology: serving electric utility customers in the 1990's, Scottsdale, AZ, USA, 5-7 Dec 1988). Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

These Proceedings contain written papers submitted by the speakers at the December 5–7, 1988 EPRI-sponsored conference Information and Automation Technology: Serving Electric Utility Customers in the 1990s. The purpose of the conference was to provide electric utilities with an overview of applications that rely on new and emerging information to enhance the value of electric service. There are 53 papers, organized into 10 subject areas corresponding to the sessions at the conference covering a broad range of information and communication technologies and electric utility applications. Three Appendices contain the conference agenda, the list of participants, and the list of exhibitors.

36258 (LBL–26260) **Proceedings of the Chinese-American symposium on energy markets and the future of energy demand.** Meyers, S. (ed.). Lawrence Berkeley Lab., CA (USA). Nov 1988. 275p. Sponsored by DOE Management & Administration. DOE Contract AC03-76SF00098. (CONF-8806261–: Chinese/American symposium on energy markets and the future of energy demand, Nanjing, China, 22-24 Jun 1988). Order Number DE89012862/JAW. Available from NTIS, PC A12/MF A01 - OSTI; GPO Dep.

The Symposium was organized by the Energy Research Institute of the State Economic Commission of China, and the Lawrence Berkeley Laboratory and Johns Hopkins University from the United States. It was held at the Johns Hopkins University Nanjing Center in late June 1988. It was attended by about 15 Chinese and an equal number of US experts on various topics related to energy demand and supply. Each presenter is one of the best observers of the energy situation in their field. A Chinese and US speaker presented papers on each topic. In all, about 30 papers were presented over a period of two and one half days. Each paper was translated into English and Chinese. The Chinese papers provide an excellent overview of the emerging energy demand and supply situation in China and the obstacles the Chinese planners face in managing the expected increase in demand for energy. These are matched by papers that discuss the energy situation in the US and worldwide, and the implications of the changes in the world energy situation on both countries. The papers in Part 1 provide historical background and discuss future directions. The papers in Part 2 focus on the historical development of energy planning and policy in each country and the methodologies and tools used for projecting energy demand and supply. The papers in Part 3 examine the pattern of energy demand, the forces driving demand, and opportunities for energy conservation in each of the major sectors in China and the US. The papers in Part 4 deal with the outlook for global and Pacific region energy markets and the development of the oil and natural gas sector in China.

36259 (NEB–23-15) **Canadian energy supply and demand, 1987-2005.** National Energy Board, Ottawa, ON (Canada). 1988. 429p. (MICROLOG–89-01285). Available from National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, Canada K1A 0E5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report presents projections of energy supply and demand, based on consultations with all provincial governments and a wide variety of industry and other interested parties, including utilities, associations, companies, research institutes, and various federal government departments and agencies. The consultations concerned methodology, assumptions as to world oil prices and economic growth, and preliminary projections. The report provides detailed information on the assumptions, methodology, and results of the analysis of supply and demand for natural gas, electricity, crude oil and equivalent, natural gas liquids, and coal. Details are given on resources and reserves, prices and costs, domestic demand, exports, production, and imports, as well as end use energy demand by sector and by fuel and region. A summary is included. Definitions, abbreviations, and terms used are also given. 79 figs., 104 tabs.

36260 (NEB–23-15) **Canadian energy supply and demand, 1987-2005.** National Energy Board, Ottawa, ON (Canada). 1988. 461p. (In French). (MICROLOG–89-01284). Available from National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, Canada K1A 0E5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report presents projections of energy supply and demand, based on consultations with all provincial governments and a wide variety of industry and other interested parties, including utilities, associations, companies, research institutes, and various federal government departments and agencies. The consultations concerned methodology, assumptions as to world oil prices and economic growth, and preliminary projections. The report provides detailed information on the assumptions, methodology, and results of the analysis of supply and demand for natural gas, electricity, crude oil and equivalent, natural gas liquids, and coal. Details are given on resources and reserves, prices and costs, domestic demand, exports, production, and imports, as well as end use energy demand by sector and by fuel and region. A summary is included. Definitions, abbreviations, and terms used are also given. 79 figs., 104 tabs.

36261 (PB–89-161160/XAB) **Energy in West and Central Africa: issues, problems, and donor activities. Final report.** RCG/Hagler, Bailly, Inc., Washington, DC (USA). Jul 1988. 92p. (HBI-REF–88-4204). Available from NTIS, PC A05/MF A01.

Also pub. as Agency for International Development, Washington, DC. Office for Energy rept. no. REPT-88-12B.

The report is divided into four sections. Section 1 is the introduction. Section 2 presents an overview of the energy situation in the region and summarizes the key energy issues and problems that emerged from the literature review. Section 3 discusses the energy-assistance programs of major bilateral and multilateral donors. Section 4 makes some very preliminary and general recommendations for targeting A.I.D.'s energy activities in West and Central

Africa. A bibliography of sources consulted to prepare the report and a brief summary of the energy situation in individual countries for which information was available are included. These country summaries are generally based upon the ESMAP energy assessments.

36262 (PB–89-173264/XAB) **GRI (Gas Research Institute) baseline projection summary. Final report.** Yanchar, J.M. Data Resources, Inc., Lexington, MA (USA). Oct 1982. 127p. Available from NTIS, PC A07/MF A01.

The GRI annual baseline projection of U.S. energy supply and demand provides a consistent framework of data which is used in planning GRI's R&D program. The summary of the baseline projection to the year 2000 discusses energy prices (oil, natural gas, coal and electricity) and energy demands in the residential and industrial sectors (including life-cycle costs, new investments and stocks, and energy consumption). Numerous tables provide detailed energy supply and demand data broken down by factors such as energy types, demand sectors, and geographical regions.

36263 (PB–89-180962/XAB) **GRI (Gas Research Institute) 1983 baseline projection forecast summary. Final report.** Yanchar, J.; Wright, C. Data Resources, Inc., Lexington, MA (USA). U.S. Energy Service. Dec 1983. 92p. Available from NTIS, PC A05/MF A01.

See also PB–89-138622 and PB–89-180996.

The Gas Research Institute (GRI) annual baseline projection of U.S. energy supply and demand provides a consistent framework of data which is used in planning GRI's R and D program. The summary of the baseline projection to the year 2000 discusses the macroeconomic outlook, energy prices (oil, natural gas, coal, and electricity) and energy demands (residential, commercial, industrial, transportation, and electric utility). Numerous tables provice detailed energy supply and demand data broken down by factors such as energy types, demand sectors, and geographic regions.

36264 (PB–89-180970/XAB) **GRI (Gas Research Institute) 1983 baseline project forecast methodology and assumptions. Final report, November 1983.** Yanchar, J. Data Resources, Inc., Lexington, MA (USA). U.S. Energy Service. Nov 1983. 113p. Available from NTIS, PC A06/MF A01.

See also PB–89-181002.

The Gas Research Institute (GRI) annual baseline projection of U.S. energy supply and demand provides a consistent framework of data which is used in planning GRI's R and D program. The report discusses the forecast assumptions and model methodology used in generating the 1983 baseline projection. Included is an explanation of the DRI Energy/Economic Modeling System, which is composed of five models: DRI Macroeconomic Model of the U.S. Economy, DRI World Oil Model, DRI Energy Core Model, DRI/Zimmerman Coal Supply and Distribution Model, and DRI Drilling Model.

36265 (PB–89-180988/XAB) **DRI (Data Resources Inc.) Energy Model/GRI (Gas Research Institute) Hydrocarbon Model and IFCAM linkage. Final report, September 1983.** Yanchar, J.M.; Smalley, G. Data Resources, Inc., Lexington, MA (USA). U.S. Energy Service. Sep 1983. 35p. Available from NTIS, PC A03/MF A01.

See also PB–89-181010.

The Gas Research Institute (GRI) annual baseline projection of U.S. energy supply and demand provides a consistent framework of data which is used in planning GRI's R&D program. The report discusses two procedures which were used in generating the 1983 baseline projection: (1) natural gas availability and pricing data derived within the DRI Energy Model based upon production and price inputs from the GRI Hydrocarbon Model; and (2) fuel price and industrial production forecasts generated by the DRI Energy Model/ IFCAM Linkage.

36266 (PB–89-180996/XAB) **GRI (Gas Research Institute) 1984 baseline projection forecast summary. Final report.** Yanchar, J.; Wright, C. Data Resources, Inc., Lexington, MA (USA). U.S. Energy Service. Feb 1985. 99p. Available from NTIS, PC A05/MF A01.

See also PB–89-180962.

The Gas Research Institute (GRI) annual baseline projection of U.S. energy supply and demand provides a consistent framework of data which is used in planning GRI's R&D program. The summary of the baseline projection to the year 2010 discusses the macroeconomic outlook, energy prices (oil, natural gas, coal, and electricity) and energy demands (residential, commercial, industrial, transportation, and electric utility). Numerous tables provide summary energy supply and demand data broken down by factors such as energy types, demand sectors, and geographic regions.

36267 (PB–89-181002/XAB) **GRI (Gas Research Institute) 1984 baseline project forecast methodology and assumptions. Final report, July 1985.** Yanchar, J. Data Resources, Inc., Lexington, MA (USA). U.S. Energy Service. Jul 1985. 119p. Available from NTIS, PC A06/MF A01.

See also PB–89-180970.

The Gas Research Institute (GRI) annual baseline projection of U.S. energy supply and demand provides a consistent framework of data which is used in planning GRI's R and D program. The report discusses the forecast assumptions and model methodology used in generating the 1984 baseline projection. Included is an explanation of the DRI Energy/Economic Modeling System, which is composed of five models: DRI Macroeconomic Model of the U.S. Economy, DRI World Oil Model, DRI Energy Core Model, DRI/Zimmerman Coal Supply and Distribution Model, and DRI Drilling Model.

36268 (PB–89-181010/XAB) **DRI (Data Resources Inc.) Energy Model/GRI (Gas Research Institute) Hydrocarbon Model and IFCAM linkage. Final report, December 1984.** Wright, C.; Smalley, G. Data Resources, Inc., Lexington, MA (USA). U.S. Energy Service. Dec 1984. 56p. Available from NTIS, PC A04/MF A01.

See also PB–89-180988.

The Gas Research Institute (GRI) annual baseline projection of U.S. energy supply and demand provides a consistent framework of data which is used in planning GRI's R and D program. The report discusses two procedures which were used in generating the 1984 baseline projection: (1) natural gas availability and pricing data derived within the DRI Energy Model based upon production and price inputs from the GRI Hydrocarbon Model; and (2) fuel price and industrial production forecasts generated by the DRI Energy Model/ EEA IFCAM Linkage.

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 35682, 35742, 35743, 35744, 35894, 36052, 36162, 36233, 36258, 36259, 36260, 36339, 37199, 37220

36269 (DOE/IG–0008/10-7) **Office of Inspector General semiannual report to the Congress, October 1, 1988–March 31, 1989.** USDOE Office of Inspector General, Washington, DC (USA). May 1989. 35p. Sponsored by DOE Management & Administration. Available from OSTI.

The semiannual report of the Office of Inspector general for the 6-month period ending March 31, 1989, meets the requirements of Section 208(c) of Public Law 95-91, as amended. Our audit, inspection, and investigative activity during this period continued to focus on identifying opportunities to enhance the effectiveness, efficiency, and integrity of the Department of Energy's programs and operations. Special emphasis was given to the planning and initiation of projects to review and evaluate the Department's activities relating to environmental, safety and health matters. Implementation of corrective action on the conditions summarized in our reports should help in achieving improvements throughout the Department. On reports where a final Departmental position was received, management committed to more efficient use of funds totaling $309.5 million. The report details the accomplishments of OIG for the first half of Fiscal Year 1989. The report is organized into four major sections. The first section presents an organizational overview of the varied missions and functions of the Department of Energy. The second section describes the significant operational results of our audit, investigative, and inspection activity. The third section discusses the OIG actions during the past 6 months to support Presidential and congressional concerns, and the final section presents an organizational overview of the Office of Inspector General and describes the major management initiatives within our office to build on past accomplishments and to increase the effectiveness and efficiency of our operations.

36270 (OE–1987) **A Citizen's guide to environmental assessment.** Ontario Ministry of the Environment, Toronto, ON (Canada). 1987. 16p. (MICROLOG–89-03973). Available from Ontario Government Publications, 880 Bay St., 5th Floor, Toronto, ON, Canada M7A 1N8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This guide offers a general introduction to environmental assessment in Ontario. It explains the requirements of the Environmenal Assessment Act and its implications, as well as the opportunities for public involvement throughout the process. Explanations are given for individual environmental assessments, hearings, class environmental assessments, exemptions, designations, and the Environmental Assessment Advisory Committee. A list of contacts and resources relating to the Act is also given. 8 refs.

36271 (SEEDS-DP–39) **Energy privatisation.** Littlechild, S.; Price, C.; Robinson, C.; Sykes, A. Surrey Univ., Guildford (UK) . Energy Economics Centre. Jun 1988. 18p. (CONF-8803164–: Conference on energy privatisation, Guildford, UK, 2 Mar 1988). Available from British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This report consists of two full papers and two summaries of papers presented at a conference which examined the already accomplished and prospective privatization of the energy industries in the United Kingdom. The areas covered in the papers are the general principles of privatization, an evaluation of the success of British Gas, a critique of the proposals for electricity privatization and an examination of the case for coal privatization. A common thread running through the papers is the perceived desirability of introducing competition into naturally monopolstic enterprises and discussion of the mechanisms for achieving this. (U.K.).

2940 Fossil Fuels

Refer also to citation(s) 35565, 35648, 35649, 35650, 35651, 35652, 35654, 35668, 35670, 35678, 35702, 35737, 36234, 36271

36272 (SEEDS-DP–39, pp. 1-7) **Why British coal should be privatised.** Robinson, C. (Surrey Univ., Guildford (UK)). Surrey Univ., Guildford (UK) . Energy Economics Centre. Jun 1988. (CONF-8803164–: Conference on energy privatisation, Guildford, UK, 2 Mar 1988). In *Energy privatisation.* Available from British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

It is argued that liberalization rather than privatization per se should be the priority of a denationalization programme. A change from state to private ownership may provide a measure of capital market discipline for management which may be more effective than government control, but this alone is likely to have only a modest effect. Competition is an essential element in any ownership scheme in order to establish efficiency standards and to stimulate changes which, in general, are of benefit to the consumer. The substitution of a private monopoly for a state monopoly in the coal industry would produce few, if any, gains for consumers. In the light of what has already happened in the gas industry, what is proposed for the electricity supply industry and the implication for the closely linked coal industry, there is a danger that the United Kingdom government's energy privatization programme will merely result in the substitution of three private monopolies for three state monopolies. (U.K.).

36273 (SEEDS-DP–39, pp. 8-15) **Lessons from gas privatisation.** Price, C. (Leicester Univ. (UK)). Surrey Univ., Guildford (UK) . Energy Economics Centre. Jun 1988. (CONF-8803164–: Conference on energy privatisation, Guildford, UK, 2 Mar 1988). In *Energy privatisation.* Available from British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The structure of the privatized British gas industry and the regulatory rules under which it operates are examined and evaluated against the yardstick of managerial and economic efficiency. The broad conclusions reached are that the monopolistic character of the structure of British Gas and the partial aspects of the chosen regulatory scheme, make the maximization of efficiency unlikely. In the light of experience it is suggested that more time should have been allowed for the discussion of structure and the regulatory regime. The industry should have been privatized as a number of smaller local monopolies with all their activities subject to regulation. Such a horizontal split of the industry would have generated some within industry competition and tighter regulation based on more information could have provided greater managerial efficiency. (U.K.).

2960 Electric Power

Refer also to citation(s) 35874, 36250, 36251, 36256, 36257, 36344

36274 (CONF-8906146–1) **The value of marginal analysis in electric power system operations.** Katzman, M.T.; Shelton, R.B. Oak Ridge National Lab., TN (USA). 1989. 15p. DOE Contract AC05-84OR21400. From 21. Latin American conference on rural electrification; Guatemala City, Guatemala; 5-6 Jun 1989. Order Number DE89013550/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Electric utilities have traditionally based their calculation of costs and derived prices on the basis of averages. Marginal analysis provides an alternative method of costing and price setting. Not only does marginal analysis yield different computations, it can lead to different and more efficient decisions. This point is illustrated by the evaluation of biomass cogeneration to a utility and the costing of rural extensions. 7 refs., 3 figs., 3 tabs.

36275 (EPRI-CU–6300, pp. 1-5) **Pricing electric power and services in a dynamic marketplace.** LeBlanc, W.; Smith, W.; Chamberlin, J. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Innovative pricing arrangements to sell electric power and services are discussed. Innovative pricing embraces the idea of offering flexible services that reflect a dynamic business environment. Pricing is one of the most powerful tools that a company can use to promote its overall marketing strategy. Utilities can no longer consider pricing as simply a means to gather necessary revenue. Marginal, avoided, outage, and competitor costs, customer value tradeoffs, and load shape objectives all must play a major role in new pricing strategies. Many utilities are already experimenting with forms of innovative pricing, such as negotiated and unbundled rates. This reflects the significant changes occurring in the electric industry. With downward pressure on fossil fuel prices and increased competition, customers are demanding more flexible energy supplies; improvements in cogeneration technology are making self-supply an option for more customers; and gas deregulation and price restructuring are increasing the competitiveness of gas with electricity for many traditional electric only markets. From the utility's standpoint, many objectives can be addressed through pricing strategies. These pricing strategies are discussed.

36276 (EPRI-CU–6300, pp. 7-14) **Innovative pricing of electricity.** Kahn, A.E. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Historically, public utility regulation has given primary attention to the total revenues that the utility companies were entitled to receive – to defining the rate base and ascertaining the proper rate of return. Specific rates tended to be based on averages, on full allocations of aggregate revenue requirements, with a large component of embedded costs – in all of these respects diverging widely from what either profit maximization or economic efficiency would have dictated. An innovative method for pricing electricity is described.

36277 (EPRI-CU–6300, pp. 15-16) **From rates to prices: the emerging concepts.** Smith, W.M. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Contemporary influences on the electric utility business environment call for an evolution of thought and perspective regarding the pricing of electric service. Factors like unregulated suppliers of electricity, natural gas deregulation, demand forecasting uncertainties, and risks associated with large capital purchases require increased flexibility in utility business planning and operations, and greater focus on the customer as a key element in electric supply and demand. While the traditional cost basis (embedded, marginal, etc.) must still play a major role, the use of prices as a tool to effect greater market penetration and customer response to a utility's selection of electric services has begun to emerge as a key element in utility planning. New pricing methods offer tremendous potential for utilities to effectively address the needs of the electric marketplace. By concentrating on particular customer circumstances, instead of on rates set solely upon cost factors, great strides in increased service value and efficient utilization can be realized. Some emerging concepts on the pricing of electricity are discussed.

36278 (EPRI-CU-6300, pp. 17-20) **Electricity pricing: a new role for an old concept.** Endries, J.M. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Some thoughts on how Niagara Mohawk views innovative pricing are presented. There are greater pressures today to develop better ways to package and price electric power. Many of the same economic arguments were advanced in the late 1970s when utilities were ordered to implement marginal cost pricing to promote efficiency in the production and consumption of electric power. Foremost among these forces of change is increasing competition in electricity markets. What's new about innovative pricing and making the transition from rates to prices are discussed.

36279 (EPRI-CU-6300, pp. 23) **New dimensions in marginal cost concepts.** Hanser, P. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Although utilities have calculated marginal costs even before the advent of the Public Utilities Regulatory Policy Act (PURPA), they have not been thought of as particularly useful. Utilities cannot make profitable pricing decisions without a clear understanding of costs, particularly incremental, or marginal, costs. Good managers know how costs will change with the changes in sales that result from pricing decisions. The key is identifying the relevant costs. The important costs are those that are forward-looking, incremental, and avoidable, i.e., marginal costs. However, in practice, an identification based on these criteria can be difficult. The development of marginal cost pricing concepts is discussed.

36280 (EPRI-CU-6300, pp. 25) **Customer outage costs: their role in system planning and pricing.** Kirsch, L.D. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Customer outage costs are very important. One reason is they provide a measure of the benefits of investments that improve the reliability of electric service. A second reason is that they are essential for estimating the costs that customers impose on other customers during periods when power systems may be unreliable. How accurate outage cost measurement can improve system planning processes; and why it is efficient for customers to pay electricity prices that are partly based on the costs that customers themselves incur during outages are explained.

36281 (EPRI-CU-6300, pp. 35-36) **Marginal operating costs: is system lambda enough?.** Stremel, J. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Hourly marginal costs play an important role in ratemaking and in other pricing policies for electric utilities. Measurements of hourly system lambdas often play an important role in determining costs for pricing policies. How system lambda is measured and its implications are discussed.

36282 (EPRI-CU-6300, pp. 39) **Competitive pricing and regulatory reform.** Willig, R.D. (Princeton Univ., NJ (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Utility ratemaking has historically been based upon embedded accounting costs. But it is widely recognized that embedded accounting costs often do not follow closely the cyclical patterns of current marginal costs. Current competitive pressures on the industry are forcing a fresh look at innovative pricing proposals that give less weight to embedded costs and more to marginal costs. The benefits of moving toward innovative pricing based on marginal costs are reviewed and some regulatory approaches to the challenges that lie in the path to implementation of innovative pricing in the electric utility industry are discussed.

36283 (EPRI-CU-6300, pp. 41) **Price differentiation by time and by service.** Chao, H. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The two broad thrusts of innovative pricing are compared, i.e., pricing by time, which includes a variety of options from standard TOU to spot pricing and pricing by service quality, which includes the full range of price differentiation by attributes such as reliability and quality. Taken together, time and service differentiation generate a menu of offerings that provides the basis for enhancing customer and utility value. Such a menu approach to time and service differentiation is the subject of a multidisciplinary EPRI study, referred to as Priority Service Methods, or PRISM. This presentation, which lays the framework for subsequent sessions, identifies the principles that distinguish time and service differentiation, discusses some examples of each, and comments on current research.

36284 (EPRI-CU-6300, pp. 43) **Strategic integration of pricing and demand-side management.** Chamberlin, J.H. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The increasing interest in developing rate structures and strategies for use as tools to influence customer actions raises concerns about consistency between rates and demand-side management (DSM) programs. Rates do not just provide incentive customers to shift load or adopt new technologies. They also strongly influence the attractiveness to both customers and the utility of other DSM efforts. The role of rate structure in DSM cost-effectiveness analysis is discussed. For several of the major cost-effectiveness tests, rate structures have a major influence in the selection of particular programs. Improper rate structures can lead to the selection and design of DSM programs which do not further the interests of either the utility or its customers. How rate strategies and DSM programs can be consistently planned and developed, utilizing equivalent evaluation approaches are discussed.

36285 (EPRI-CU-6300, pp. 45-46) **Rate manager's perspective: theory to practice.** Wharton, J.B. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

There is no concept closer to the heart of economics than the price of goods and services. Setting innovative rates for electric service is a fertile ground for applied economic science. During the past two years, the New England Electric System (NEES) has launched a major thrust in new rates and monetary incentives to encourage conservation and load management. This includes TOU rates, interruptible rates, end use rates, real time pricing and conservation and load management grants. For all of these programs, NEES has sought to establish a strong theoretical foundation consistent with business philosophy. NEES business philosophy is to maintain profitability by cost containment, resource diversity, customer satisfaction and good regulatory relations. NEES approach to innovative rate design is discussed.

36286 (EPRI-CU-6300, pp. 49-50) **Forecasting day-ahead marginal costs.** Krantz, M. (Niagara Mohawk Power Corp., Syracuse, NY (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Niagara Mohawk's Hourly Integrated Pricing Programs provides participating industrial customers with hourly energy prices, one day in advance. This experimental rate covers the customers' contribution to the utility's fixed costs through an access charge; hourly energy prices are based directly on the utility's forecast hourly marginal cost. Hourly marginal costs have two components, marginal operating cost (which is primarily fuel) and marginal outage cost (which reflects the impact of a load increment on the reliability of supply). Since Niagara Mohawk is a member of the New York Power Pool (NYPP), it was originally proposed to estimate hourly marginal costs by modifying techniques that NYPP uses for security constrained dispatch (SCD). The problems that made that approach impractical to implement are discussed.

36287 (EPRI-CU-6300, pp. 51) **Validating marginal cost estimates.** Kahn, E. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Marginal energy costs are forecast using production simulation models. The California Public Utilities Commission (CPUC) has been directed by the state legislature to validate the use of these models. The CPUC implemented this direction by undertaking extensive backcasting studies. The most substantial of these compared the performance of PROMOD and ELFIN in replicating the operating experience of Southern California Edison (SCE) in 1985. The variation in SCE marginal cost in this period was principally determined by the availability of low-cost economy energy from the Southwest, and minimum load constraints on the SCE oil and gas system. The validation study required extensive analysis of the economy energy transactions entered into by SCE. Accounting conventions governing the reporting of these transactions are complex and not always consistent. Some of the most important data, involving rejected economy energy, was of poor quality. Translating available data into modeling conventions required judgment. The difference between reasonable approximations and model-specific hard-wiring was not always clear to participants. The process of validating these marginal cost estimates is discussed.

36288 (EPRI-CU-6300, pp. 53) **Measuring outage probabilities.** Sullivan, R.L. (Univ. of Florida, Gainesville (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A discussion of commonly used component reliability models and system reliability analyses is presented. Further discussion of the parameters involved, how they are defined, and how they are measured are presented. A summary of current reliability measuring techniques and reliability data collection efforts are discussed.

36289 (EPRI-CU-6300, pp. 57) **Competition and bypass in regulated markets.** Spulber, D.F. (Univ. of Southern California, La Canada (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The effects of bypass and partial deregulation on the rate structure of regulated firms are examined using a market model. The possibility of introducing competition without bypass through shared ownership, access rights and vertical divestiture is assessed and compared to rate-of-return regulation. A cost test for determining the desirability of vertical integration is applied to an examination of vertical divestiture of transmission facilities.

36290 (EPRI-CU-6300, pp. 59-60) **Pros and cons of negotiated rates.** Wicks, J. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Negotiated rates and individual customer contracts are not unduly discriminatory per se, nor are tariff rates inherently free of undue discrimination. As a practical matter, though, special contracts appear so conspicuously discriminatory that regulatory resistance to individual ratemaking ensures that the practiced will be proscribed. Tariff offers, however contrived the eligibility criteria, enjoy a cosmetic advantage over individual contracts; yet poorly designed tariffs may be equally discriminatory and more pervasively damaging. The advantages and disadvantages of negotiated rates are discussed.

36291 (EPRI-CU-6300, pp. 61) **Strategies to meet increased competition.** Hansen, D.P. (San Diego Gas and Electric Co., CA (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A discussion of rate strategies must start with a description of recent electric rate history. In the 70's embedded cost rate designs gave way to marginal cost designs in California. The marginal cost based designs adopted in California recovered large portions of fixed utility costs in volumetric energy rates. The purpose of these designs was to foster conservation and self-generation at any cost. Under competitive pressure these bundled designs gave way to a return to cost based rates emphasizing proper price signals for each component of service. A similar situation occurred with cost allocations. During the oil embargo years the Commission sought to shield residential customers from rate shock by allocating disproportionate amounts of rate increases to the industrial classes. In part, SDG&E's solution to this problem was to cost base and unbundle. This is a process of removing inter-class subsidies and of charging rates that accurately reflect the cost of each component of service. In addition, new tools have come into play which can be used by the utility to increase competitiveness. These tools run the gamut from individual negotiated rates to optional commercial tariffs to utility supported load control programs such a TES. These strategies are discussed.

36292 (EPRI-CU-6300, pp. 65) **Assessing the value of service reliability.** Walther, R.J. (Southern California Edison, Rosemead, CA (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Increasingly, electric utilities are asking themselves how do our customers value the reliability of our service. At Southern California Edison Company, a multi-step program both to assess the value of service reliability and to make use of the information developed was undertaken. The focus of this presentation is on the development of value of service reliability information. The presentation begins with

a review of the value of service reliability concept and the alternative measurement approaches. A description of the steps being followed at Southern California Edison Company to assess the value of service reliability to the customers in presented. These steps include a Scoping Study, Preliminary Measurement Studies, Customer Survey, and Customer Case Studies. In reporting on these activities, special attention is given to the design and implementation of the two Customer Surveys, which are nearing completion.

36293 (EPRI-CU-6300, pp. 67) **Derivation of service values from surveys.** Doane, M.J. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Contingent valuation methods involve asking individuals in survey or experimental settings to reveal their personal valuations of increments (or decrements) in unpriced goods using contingent markets (if this happened what would you be willing to pay?). Surveys employing this technique have been used to measure the welfare gains attributable to improvements in air and water quality and, more recently, to estimate the value of electric service reliability (i.e., the cost of power outages). The use of contingent valuation methods in the context of measuring outage costs is discussed. An emphasis is placed on survey design issues (e.g., the framing of contingencies) and appropriate methods for data analysis.

36294 (EPRI-CU-6300, pp. 69) **Estimating outage costs from demand analysis.** Caves, D.W. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Although the importance of outage costs for planning and pricing is becoming widely recognized, reliable estimates of outage costs continue to price elusive. Survey-based approaches are relatively inexpensive and quick to implement, but their results are difficult to verify. No one knows the extent to which customers actual behavior will reflect their responses to hypothetical survey questions. The major alternative - analysis of market data - is based on actual behavior, but has been plagued by lack of suitable market data. Recently, however, new programs have begun to produce data that would shed light on customer outage costs. The data that are becoming available for obtaining outage cost estimation is reviewed and ways by which the utility industry can maximize the value of the information gained from market-based approaches are suggested.

36295 (EPRI-CU-6300, pp. 83-90) **Revenue and rates of return requirements.** Christensen, L.R. (L.R. Christensen Associates, Inc., Madison, WI (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Advanced pricing systems, such as priority service or real-time pricing are important tools for achieving the benefits associated with marginal cost pricing. But since marginal resource costs are often substantially different from average embedded costs, advanced pricing systems can lead to revenue collections that are substantially different from traditional revenue requirements. Because the revenue requirement remains a keystone in the utility ratemaking structure, some mechanisms must be found for achieving reconciliation between marginal cost based rates and the revenue requirement. The two major approaches to revenue reconciliation are usage-based and usage-independent methods. This presentation compares and contrasts these methods in terms of their implications for economic efficiency, net revenue stability, equity, and customer acceptance. Existing real-time pricing projects are reviewed in the context of the approach to revenue reconciliation.

36296 (EPRI-CU-6300, pp. 91-92) **Demand charge: does it fit in?.** Kleindorfer, P.R. (Univ. of Pennsylvania, Philadelphia (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Two issues related to demand charges are considered. First, what arguments can be provided for and against the use of demand charges for industrial and large commercial consumers? Second, do demand charges have a place in innovative pricing of electricity? The advantages and disadvantages of demand charges in general are discussed with respect to innovative pricing proposals. The bottom line to the analysis is that demand charges are of continuing importance for standing rate schedules for industrial and commercial consumers, but they are not appropriate ingredients of real-time prices. For real-time pricing, demand charges do not advance the cause of efficiency for either the customer or the utility.

36297 (EPRI-CU-6300, pp. 93) **Innovative pricing: do benefits outweigh costs?.** Flaim, T. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Assessing the benefits and costs of innovative pricing concepts is necessary to both design new rates and to determine whether they should be implemented. The results of the assessment that was conducted for Niagara Mohawk's Hourly Integrated Pricing Program (HIPP) are presented. HIPP is a form of real-time pricing that has been developed at Niagara Mohawk for industrial customers. It features hourly energy prices that are forecast one day in advance and a monthly access charge to handle reconciliation between revenues and embedded costs.

36298 (EPRI-CU-6300, pp. 97-98) **Technological requirements for new pricing strategies.** Reddoch, T.W. (Electrotek Concepts, Inc., Knoxville, TN (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

One important consequence of new pricing strategies is an inherent escalation in information management requirements. Implementation requirements are a significant departure from historical methods of costing, pricing, metering, and billing of electricity. However, customer participation is increased through the need to better understand the rate program, understand the use of modern technology and its relationship to the rate, and a greater need to interact with the utility and its representatives. The primary requirement for the overall technology configuration for implementing new electricity pricing strategies is a combination of hardware and computer software carefully fabricated to provide an interactive system between the utility and the customer. The major elements of the pricing system are presented.

36299 (EPRI-CU-6300, pp. 99-100) **Options for broadcasting price & information.** Abbott, R.E. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The delivery of pricing information to the utility customer is a basic requirement of many more advanced flexible or dynamic rate structures. Indeed, the efficacy of many suggested rates structures depends heavily on the existence of communications media and enabling technology which delivers the information to customers reliably, without errors and at a justifiable cost. Large industrial and commercial accounts, with their high associated revenues, permit more choices in communications technologies. At the other extreme, dissemination of prices to residential customers severely tests the use-economics of any technology. In that cost-sensitive environment of residential customer applications, compromises on equipment design, fabrication, installation and operation are

inevitable. These necessary compromises, in turn, may not yield adequate reliability and accuracy. An overview of technologies is presented which have been or are being used for disseminating and retrieving information from customer premises, including AM and FM broadcast and VHF radio, ripple, distribution power line carrier, and others. The technologies which are emerging as candidates for the coming decade and beyond, including satellite, fiber, ISDN, derived channel telephone, cable and others are discussed.

36300 (EPRI-CU–6300, pp. 101) **Working systems from off-the-shelf components.** Eppolioto, P. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Several variable pricing system configurations have been developed and implemented by utilities. These systems consist primarily of components typically available as off-the-shelf that have been integrated to satisfy the needs of a particular variable pricing program. Typical off-the-shelf components consist of both hardware and software. In particular, personal computers with supporting peripherals like monitors, printers, modems, and solid state metering systems constitute available hardware. Software packages including Lotus, R-Base, D-Base, metering master station operating systems, etc. have been used. Communication between customer and the utility have used dedicated telephone lies, with methods such as electronic mail or conventional direct modem transactions. The primary value of utilizing off-the-shelf components is to reduce the development time for the RTP system and to improve reliability. Three RTP system configurations are analyzed to explore how such systems have been successfully configured. Niagara Mohawk Power Corporation's Hourly Integrated Pricing Program (HIPP) system configuration is discussed. In particular, the individual system elements are described, and the links connecting the elements of the systems presented. Further, system implementation for Pacific Gas and Electric and Southern California Edison are summarized.

36301 (EPRI-CU–6300, pp. 105-106) **Customer response to real-time pricing.** Crane, C.M. (Pacific Gas and Electric Co., San Francisco, CA (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Demand-Side Real-Time Pricing (RTP) is an innovative and viable pricing experiment at PG&E since its inception in 1984. It provides customers with another rate option and benefits the Company because the daily hourly prices accurately reflect PG&E's cost to serve. The response of the 15 PG&E program participants in the program to real-time pricing is presented.

36302 (EPRI-CU–6300, pp. 107) **Exploring new dimensions in RTP.** Fagan, J. (Southern California Edison Co., Rosemead (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Southern California Edison Company's (SCE) current Real-Time Pricing Experiment and Spot Pricing programs are described. Both programs test the use of real-time pricing information on customers, but each has different goals. SCE's Real-Time Pricing Experiment focuses on testing customer response to simulated real-time prices. This experiment is currently under way for ten of SCE's largest commercial and industrial customers. A wide range of continually varying prices is transmitted to these customers. Normally, prices are provided well in advance of when they are charged. SCE's Spot Pricing Program seeks to encourage incremental on-peak sales through use of a discounted rate. All incremental on-peak sales are fully interruptible. The rate which applies to these additional sales is initially set at a fixed minimum rate level, but is subject to escalation in real-time if: (1) marginal energy costs increase substantially; or (2) a shortage of capacity is imminent. Customers are also subject to a number of provisions which discourage their shifting of load to the on-peak period or adding surplus load on-peak.

36303 (EPRI-CU–6300, pp. 119-120) **Two-part pricing in real-time.** Tramutola, T. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Niagara Mohawk is conducting research to measure customer response to a unique version of real time pricing - a two part rate which facilitates pricing energy at short-run marginal cost. Confronted with other utilities' limited success in attracting real time pricing customers and with concern over whether or not RTP is economically and technically possible, Niagara Mohawk developed a unique rate design for their Hourly Integrated Pricing Program (HIPP) which offers revenue neutrality on a customer specific basis. Customer recruitment in established RTP program has suffered from distorted price signals and from the use of energy price adders or multipliers. Niagara Mohawk is offering large industrial and commercial customers marginal cost-based pricing on an hourly basis. The two-part rate design maintains customer specific revenue neutrality with respect to existing time-of-use rates with respect to their historically established consumption pattern, referred to as the customer baseline load.

36304 (EPRI-CU–6300, pp. 123-129) **Pricing innovation and latent technology development: the chicken and egg syndrome.** LeBlanc, W. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Latent technology is technology which would exist if pricing was set through competitive market forces (or marginal costs, to a lesser extent) instead of regulatory statutes. Only recently has the trend increased toward offering prices which vary by season and time of day. In addition, cross subsidies between customer classes and between customers themselves have given improper price signals to the majority of electric power consumers. These price signals have placed a perverse set of incentives for technological development related to the industry. The Chicken and Egg Syndrome refers to the question: Do new technologies create the need for expanded service options, or does the need for new pricing mechanisms (such as TOU pricing) create openings for new technologies? Technology arrives from both directions. The vast majority of new electrotechnologies evolve just like most products. A need is recognized, existing knowledge is packaged in a new way of incrementally improved, and buyers are willing to pay a higher price for a better product. Entrepreneurs and big companies alike recognize and capture these technology markets.

36305 (EPRI-CU–6300, pp. 131) **Modifying process operations in response to innovative pricing.** Stern, K.M. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The concept of industrial load shaping is explored from both fundamental and practical perspectives. Application of industrial load shaping to the following industries is discussed. Examples of successful past projects are discussed along with the ingredients necessary to achieve additional future successes.

36306 (EPRI-CU–6300, pp. 133-142) **Using variable prices to improve productivity.** Smith, D.A. (Water Pollution Control Facility No. 16, North Tonawanda, NY (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The water pollution control industry, often in the forefront of the on-going program to protect and rehabilitate our environment, would appear to be an unlikely prospect for energy conservation and experimentation. Yet, it is an industry which expends between one-fourth and one-third of its total operating costs on electric power, with the larger plants spending in excess of $1 million per year. As such, these largely public sector operations should be thought of as prime targets for innovation. To affect this, however, power industry incentives must be coupled with management rethinking in the wastewater industry; for ingrained in most environmental managers is the conservative caveat that redundancy, reliability and past practice should remain preeminent. Using a large operating wastewater treatment facility as an example of what may be accomplished, an evaluation of the impact of various pricing inducements is examined. The facility involved, the Town of Amherst Water Pollution Control Facility, is currently experimenting with several forms of energy conservation/innovation. These forms of energy conservation are discussed.

36307 (EPRI-CU–6300, pp. 145-154) **Incentives for residential direct load control.** Noell, S.K. (Southern California Edison Co., Rosemead (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Southern California Edison has pioneered many of the existing methods for designing, communicating and testing rate and service options. An overview of Edison's experience in measuring and influencing customer attitudes toward direct load control is presented. The presentation focuses on the incentives used to encourage customer participation. Edison's energy management portfolio has included several air conditioner cycling test programs, a rapid program expansion, and the current, stable production environment. The concept of whole house load control has been extensively explored through the DEMAND SUBSCRIPTION SERVICE Test Program. Designed incentives, marketing plans, and operational procedures have been accomplished while considering customer preferences and needs. The measurement of customer needs and preferences is inherent to test and production program management. Analyses of focus groups, surveys, response rates, attrition, and load research all contribute to the comprehensive, interdisciplinary, flexible approach that has evolved at Southern California Edison.

36308 (EPRI-CU–6300, pp. 155-163) **Rate manager's perespective: theory to practice.** Wharton, J.B. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

In 1987, the New England Electric System (NEES) responded to an approaching period of capacity tightness by launching its Cooperative Interruptible Service program for above 200 kW C&I customers. The success of this type of dispatchable load program depends on an artful combination of rate design, marketing, operations and monitoring. The focus was on the rate design where NEES made an innovation on previous designs. The innovation was motivated by the findings of an EPRI research project on innovative pricing which was conducted by Christensen Associates. A participant's load factor was revealed to be a prime determinant of the relationship between the amount of load actually shed and the load credited in the standard contract. The solution was to factor each participant's load factor into the tariff's credit calculation. This approach makes the tariff more efficient and more fair. Other aspects of the design and implementation of interruptible rates are summarized.

36309 (EPRI-CU–6300, pp. 165-175) **GPU's experience with curtailable loads.** Sweeney, L.E. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The operating companies of the GPU System have utilized curtailable rates for more than 20 years. In the mid-sixties the curtailable concept was introduced via a contract for a single large air-reduction customer. Curtailments were triggered in order to avoid setting a new annual peak. The GPU System now serves some 70 customers, with curtailable loads ranging in size from as small as 0.3 MW up to as large as 120 MW. The value/pricing theory has remained relatively constant over the years. However, some tariff provisions have been modified to enhance the service as the need arose. The basic curtailable provision provides compensation on the basis of 20 curtailments per annual period with a cumulative 150 hours of curtailment. One operating subsidiary of GPU offers extended off-peak billing hours if the customer agrees to: (1) curtail 40% of its connected load and (2) curtail an additional 6 times for 45 additional hours.

36310 (EPRI-CU–6300, pp. 179-180) **Efficiency vs. fairness retail pricing.** Bidwell, M.O. (National Economic Research Institute, White Plains, NY (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This discussion is divided into two sections. The first section explains why there is a simple answer to the equity versus efficiency controversy. The second section explains why there are not simple answers. The simple answer to the equity versus efficiency controversy is that one should always to with efficiency. There are many reasons for taking this position. Unlike equity, efficiency is definable and measurable. Moreover, economic efficiency is part of a general result in a field called welfare economics. The economically efficient result can be shown to maximize the total amount of goods and services that can be produced using the scarce resources available. This particular result can be extended to situations where the regulated revenue requirements does not equal the revenues that would be collected if all prices were set at marginal cost. In this regulated situation, the use of Ramsey pricing provides maximum economic welfare and greatest possible efficiency.

36311 (EPRI-CU–6300, pp. 181-202) **Market segmentation and pricing for competitive markets.** Camfield, R. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Both industry insiders and outside observers point to a major change in the focus of electric utilities; namely, that the industry is becoming more competitive with fairly intense interest in marketing. Contemporary electricity markets, moreover, now contain substantial elements of competition from alternative sources of power, new technologies, and adjacent central station suppliers. Thus, segments of electricity markets can be rendered contestable. Long enjoying monopoly power, electric suppliers and their regulatory agencies need to evaluate current pricing policy with reference to these intensified competitive pressures. Two pricing options are presented. First, the electric supplier can segment markets and reprice consistent with the principle of inverse elasticity rule, sometimes referred to as quasi-optimal, or Ramsey pricing. It is shown that the efficiency gains of Ramsey prices are best achieved when applied to specific market segments. Often, the inverse elasticity rule is considered only within the context of class prices, and without regard to substantial differences in price sensitivity within classes. Secondly, the incumbent electric supplier can engage in flexible pricing with negotiated rates. A loss minimizing policy, flexible pricing mitigates lost market share in those market segments wherein customers have opportunities to substitute to alternative suppliers. These two pricing systems are not necessarily exclusive; both strategies may be necessary to sustain market share within a contestable market environment.

36312 (EPRI-CU–6300, pp. 203-213) **Regulatory perspective on interruptible rates.** Tierney, S.F. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30

Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Under certain price and contractual terms and conditions, interruptible contracts with customers can offer electric companies a cost-effective, flexible and innovative way to obtain capacity within a relatively short planning and development lead time. From a regulatory perspective the offering of interruptible rates and contracts to obtain cost-justified, firm, dispatchable interruptible power ought to be part of a utility's supply tool kit, particularly in circumstances where the utility's projected available capacity over the next few peaking seasons is expected to be tight vis-a-vis its projected load and reserve requirements. Certain regulatory principles are discussed for evaluating the pricing and other terms and conditions of interruptible contracts as appropriate for inclusion in a utility's least-cost,, integrated resource plan.

36313 (EPRI-CU–6300, pp. 217) **Marketing rates that enhance net revenue.** Herriges, J. (Laurits R. Christensen Associates, Madison, WI (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

There is a growing interest in the electric power industry in developing a variety of rate and service options. The concept of offering a single good (i.e., kWh) at a single price is being replaced by an array of tariffs that differentiate electricity according to its quality attributes, including time-of-day, level of reliability, voltage level and geographical location. By offering a menu of rate options, utilities can achieve a better match between customer demand and the costs of producing electricity. The problem with rate menus arise when the tariff options do not reflect the cost of service. In many instances, voluntary rate programs enable individuals to obtain the same service at a reduced rate. Rather than leading to a more efficient usage of electricity, customer self-selection can result primarily in a redistribution of wealth, with volunteers enjoying benefits financed by non-volunteers. The problem of revenue erosion and/or redistribution that can result from voluntary Time-of-Use (TOU) and Interruptible/Curtailable Rate programs, as well as the potential for alleviating this problem through careful program design and marketing is discussed.

36314 (EPRI-CU–6300, pp. 219-234) **Importance of market segmentation in new service and rate offerings.** Caves, D.W.; Herriges, J.A.; Windle, R.J. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Among the underlying characteristics of Integrated Value-Based Planning (IVP), and the closely related Priority Service Concept (PRISM), is the principle that customers be given a selection or menu of price and service offerings. The advantage of these schemes, in principle, is that they encourage changes in usage patterns that lead to a closer match between the marginal cost of service and the value of service to individual customers. But in practice the menu characteristic can cause the serious side-effect of net revenue erosion for the utility. This occurs when a segment of the customer population is able to select one of the new offerings and obtain a considerable bill reduction without making any change in usage patterns. Because the problem arises only for segments of the population, market segmentation research may provide a way to minimize the damage.

36315 (EPRI-CU–6300, pp. 235-243) **Effects of voluntary TOU rates on revenues.** Goett, A.A. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The revenue impact of voluntary time-of-use (TOU) rates is a central issue surrounding their design and promotion by electric utilities. Voluntary tariffs may cause revenue attrition that must be recovered through increases in other rates or lost through decreased profits. Recent theoretical work on public utility pricing has shown that if there are no costs to administer a voluntary tariff, it is possible to design such a rate that increases net revenues. However, with positive administration costs, the practical feasibility of designing a voluntary rate that increases revenues and that appeals to a significant portion of customers depends on the distribution of customer characteristics in the population. The participation, load, and revenue impacts of several alternative voluntary TOU rates were investigated using a fairly general model of customer demands by time-of-use and the results of a recent study of customer response to a voluntary TOU rate experiment at Pacific Gas and Electric Company (PG&E). It was found that many rates that both increased gross revenues and were economically attractive to a significant percentage of residential customers. A smaller number of economically attractive rates increased net revenues based on estimates of metering, program administration, and generation costs from PG&E. The properties of these rates relative to the marginal costs of electricity and the distribution of demand elasticities in the customer population were investigated.

36316 (EPRI-CU–6300, pp. 245-252) **Influencing customer investment through financial incentives.** Miedema, A.K. (Research Triangle Institute, Research Triangle Park, NC (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Financial incentive programs can significantly affect the price of services that electricity provides through their effects on the cost of efficient technology investments. In that sense they are electricity pricing options. The costs and benefits of such program options must be carefully weighed. A framework for such an assessment is presented and the available evidence on the impact of factors that affect both costs and benefits is described. Those factors are grouped into those that influence customer adoption (investments), those that affect electricity usage after adoption, and important external conditions. The evidence suggests the need for caution and thoughtful evaluation before proceeding with new programs. The final section offers specific implications of the available evidence for the process of planning and designing financial incentive programs.

36317 (EPRI-CU–6300, pp. 255-262) **Electricity - raw material.** Keierleber, D.P. (Liquid Carbonic Industrial Medical Corp., Chicago, IL (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Electricity represents as much as 70% of the total operating expenses of an air separation plant. Since air is free, final site selection for a new plant depends heavily on the cost of the real raw material - electricity. The decision to build a new plant (which will have a 10,000 - 15,000 kW demand with a 98% load factor) could be for new business growth; but, it could also be a purely cost reduction decision to shutdown an existing facility and relocate in a less expensive power grid.

36318 (EPRI-CU–6300, pp. 263-274) **Taking charge of electricity costs.** Malatzky, A. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Large, electricity intensive, industrial customers require greater flexibility and innovative approaches from their suppliers if they are to survive and grow. The grouping of these customers as Industrial fails to take into account the vast differences within that class. Utilities and regulators need to be aware of and sensitive to these

differences and to be responsive by allowing risk and experimentation. If a utility does not understand its markets and fails to move aggressively to meet the needs of the market, it will lose sales. Market knowledge requires that individual utility companies learn from the source, the customers. Utilities and regulators need to listen and to learn. They can no longer simply price their product without regard to customer needs and expect their customers to buy. Utilities and regulators need to work with their customers to develop rates and contracts that support, rather than hinder, their large customers.

36319 (EPRI-CU–6300, pp. 275) **Large industry's view of innovative pricing.** Noble, R.A. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Large manufacturing companies, beset by competitors inside and outside the US, find it necessary to reduce or hold down costs, increase product quality, and give more service to customers. In doing so, these companies - particularly those for whom energy is a major raw material - focus increasingly on energy costs, and look for flexibility and accommodation from their suppliers. In response, many utilities, with cooperation from state public service commissions, are developing innovative new pricing and incentive strategies. A number of these are examined and viewed from the point of view of a major power user. Free-market and regulated industries coexist in a friendly, dependent, but uneasy relationship. Sympathetic attention by each to the needs and goals of the other can result in mutually satisfactory solutions.

36320 (EPRI-CU–6300, pp. 279-280) **Power quality: a utility perspective.** Mason, R.S. Jr. (Bayboro Corp., St. Petersburg, FL (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The advent of the microprocessor, and its subsequent proliferation throughout the world, has both enhanced and complicated the lives of all of us. Almost everything we do, whether at home or at work, involves a microprocessor in one way or another. But unlike machinery of the past and the inventions of Edison, the microprocessor is highly sophisticated and extremely sensitive, tolerating little or no power abnormalities. Microprocessor failures are caused by a variety of sources, including the environment and even other equipment. In the commercial sector, more than 80 percent of all computer-based equipment problems are caused by the customers themselves. Customers seeking solutions to microprocessor operating problems have been looking to a variety of sources for help, but more and more are now turning to their electric utilities since these are the people who supply the electricity needed to operate the devices.

36321 (EPRI-CU–6300, pp. 281) **Guaranteed rates: a marketable option?.** Sergel, R.P. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Non-price factors are critical to the marketing of any product. Not every customer is looking to buy bread at the lowest price. Likewise, for electric customers, price is just one of many important product attributes. Guaranteed Rates are designed for customers who desire price stability over a three to twelve month period. Three different aspects of the guaranteed rate option were evaluated. First, the characteristics of customers who have expressed an interest in guaranteed rates were reviewed. Second, regulatory considerations concerning this type of ratemaking were examined. In particular, the allocation of the risk/rewards associated with guaranteed rates was evaluated. Finally, the use of rate contracts to implement guaranteed rates was considered. The overall conclusion is that guaranteed rates provide an attractive opportunity for both the utility and its customers.

36322 (EPRI-CU–6300, pp. 283) **Attributes of simplicity in pricing.** Engel, D.C. Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Today's competitive environment has accelerated the interest in innovative rate designs to better mirror customer needs and interests. Utilities have responded with unbundled and more complex rate structures and contract mechanisms. Yet the competition is marketing their products based upon simplified and stabilized cost comparisons relative to the uncertainty and complexity of utility rates over time. The need to balance rate design innovations with pragmatic marketplace considerations is discussed. Some of these considerations include: rate applicability to a sufficient customer segment, level of customer sophistication, marketing/sales staff comprehension, and internal implementation constraints.

36323 (EPRI-CU–6300, pp. 287-298) **Cogeneration and competition.** Cicchetti, C.J. (Harvard Univ., Boston, MA (USA)). Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. (CONF-8809323–: Conference on new dimensions in pricing electricity, Syracuse, NY, USA, 28-30 Sep 1988). In *New dimensions in pricing electricity. Proceedings.* Order Number DE89010357/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This year marks the tenth anniversary of the enactment of the Public Utility Regulatory Policies Act of 1978 (PURPA). As it passed through Congress, the electric utility industry and its critics thought they were debating legislation that would profoundly change electric utility regulation in the United States. Ironically, these participants were correct in their assessment of the consequence of PURPA, but for the wrong reason. It was not the much heralded marginal cost pricing and tariff reform aspects of PURPA which became the seeds for the subsequent regulatory reform. Instead, it was the nearly overlooked section 210 dealing with cogeneration which has had the most profound effect on the electric utility industry. The effects of PURPA on the cogeneration industry are discussed.

36324 (EPRI-CU–6332, pp. 1.1-1.8) **Introduction: demand-side management – a fundamental part of utility planning.** Hanser, P. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

In 1984, EPRI published a report that stated that a key challenge to the electric utility industry in the 1980s will be the successful integration of traditional supply planning and operation with the emerging concept of demand-side management. It is clear now, near the end of the decade, that the report was correct. The concept of demand-side management is no longer emerging. It has reached maturity, measured by the level of success demand side management (DSM) programs have had. DSM has emerged as one of the most powerful techniques available to utility planning staffs. Given the rapid transformation of the power markets over the past few years, the skillful integration of DSM with supply-side management no longer seems such a futuristic concern. It has become essential to the long term health of the industry. The concept of demand-side management is simple: to influence customer use of electricity for the mutual benefit of both customers and the utility. Implementing DSM programs turns out to be somewhat complex. There are five major components to demand-side management, some of which have more than one part. The complexity stems from the inherent flexibility of well-conceived DSM programs as well as the comprehensiveness of the structure under which they are developed and operated. The five components of DSM are discussed.

36325 (EPRI-CU–6332, pp. 10.1-10.20) **Alternative technologies for DSM in the commercial sector.** Blatt, M. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services,

Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The commercial sector in the United States is the fastest growing market segment of electric utility industry and it is subject to intense competition, primarily from the gas industry. There is competition for loads that have traditionally been electric loads - such as space cooling and refrigeration loads - that are now being threatened by cogeneration and other gas-fired equipment. There are also opportunities in market segments where there has traditionally been competition, and the gas industry is now making greater efforts that could cause the market share of electricity to decrease. These loads are space heating, water heating, and cooking. How energy is used in the commercial sector in the United States is shown. This is all the energy consumed at the point of use; adding up to about six Quads. Space heating is by far the biggest use of energy in the commercial sector. Some alternative technologies to demand side management in the commercial sector are discussed.

36326 (EPRI-CU–6332, pp. 12.1-12.9) **Motivations for and evolution of DSM.** Smith, W.M. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The motivation for beginning a demand-side management (DSM) in the electric utility industry is explored. The kinds of end-use technologies to employ in DSM are discussed. These technologies include direct load control of appliances, interruptible/curtailable rates for large commercial and industrial customers, time-of-use rates for load shifting, and promotion of new electricity uses.

36327 (EPRI-CU–6332, pp. 13.1-13.9) **Institutional aspects of DSM in France.** Rabut, P. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A short description of the Electricite de France (EDF) tariff evolution, focused on its links with demand-side management is presented. Information is given on which utilizations are affected by changes in tariffs and whether they influence peak clipping (knocking off the peaks, with a loss in the total sales of energy), load shifting (shifting the consumption to a different time), and valley filling (filling up the load curve during off-peak periods, with an increase in the total sales of energy). These issue are discussed in terms of both daily and seasonal energy use patterns.

36328 (EPRI-CU–6332, pp. 14.1-14.21) **Institutional aspects of DSM in Italy.** Camplani, A. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

ENEL's institutional task is to provide the country with an electricity supply commensurate with its development requirements at the minimum cost. In performing this task, the ENEL Board of Directors approved the program of January 14, 1988, which takes into account the new situation of the country, and particularly the parliamentary resolution of December 18, 1987. Under this resolution the government undertook to submit a new PEN (National Energy Plan) along specified guidelines. The planning horizon of ENEL programs is the year 2000, I.E., thirteen years from now. Considering the long lead-time of base-load power plants, this horizon is a minimum one to gain insight into evolution of the sector and formulate an investment program for the 1988-1992 five-year period, as required by the parliament. The goals of ENEL programs are discussed.

36329 (EPRI-CU–6332, pp. 15.1-15.17) **Demand-side management in the Federal Republic of Germany.** Schaefer, H. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The very general topic of demand-side management can be subdivided into the subjects of load management, strategic conservation, and load growth, load management being by far of the greatest importance in practical operation. For this reason, the ways and means as well as the results of load management in the Federal Republic of Germany are described.

36330 (EPRI-CU–6332, pp. 16.1-16.7) **Institutional aspects of DSM in the United States.** Smith, W.M. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

In the United States, more experimentation has been done than implementation of actual programs with a wide variety of activities. There has been a lot of interest in rate treatments, i.e., time-of-use rates and interruptible/curtailable rates. There are thermal energy storage programs, rebates for efficient appliances, and instances of whole towns working on some kind of conservation or load management objective to shift or reduce energy use. One of the key areas is that of monitoring. In the United States, most utilities bill on a monthly basis. Many customers with demand as low as ten kW have demand metering as well as energy use metering. Time-of-use metering, in both mandatory and optional programs, has become widespread. There are hundreds of thousands of customers on time-of-use rates around the country. Many utilities are now monitoring residential load shapes, commercial load shapes, and industrial load shapes at the facility or whole-building level, and many, because they have implemented direct load control and other things like that, have actually monitored end uses. So there are data on what those air conditioners look like when they are operating in commercial or residential establishments. There is information on what the water heaters look like in residential establishments, and there are a number of other kinds of things like dishwashers, dryers, and electric space heaters being monitored.

36331 (EPRI-CU–6332, pp. 17.1-17.7) **Discussion on planning and DSM.** de Voghel, L. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Planning for the implementation of demand-side management programs in the electric utility industry is discussed. Now there is a new approach - strategic planning - which takes into account the interaction of demand and supply. This new approach to demand-side management is discussed under the following topics: the role of corporate organizations, long-term DSM planning, using DSM to achieve corporate goals, and balancing the mismatch between supply and demand.

36332 (EPRI-CU–6332, pp. 2.1-2.19) **Alternative rate design in the United States.** LeBlanc, B. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

An overview of alternative rate designs in the United States is presented. Conditions in America that are driving rate designs right

now are discussed. The traditional view of rate design is that there is a certain amount of revenue that needs to be collected from all the kWh sold. The total revenue requirement is based on an allocation of cost-of-service (COS) from which some level of rates is determined. The traditional focus has been on the recovery of costs; always looking at the money one needed to collect. Many utilities are starting to take a different look at how they are pricing electricity on a customer-by-customer basis. They are looking at what their profit targets are; what the utility wants to accomplish in the way of profits. They need to maintain market share. At the same time, there is more competition - alternative sources of electricity of American customers. A key distinction of the strategic view of pricing is that it focuses on what the market condition are as opposed to what the revenue requirements are. This gets a little more complicated. The utility tries to hit the bulls-eye and the path is anything but a straight line. There are equity issues with respect to the customers who do not have choices, such as residential and small commercial customers. There are regulatory concerns, which are very important in the United States; they drive a lot of what rate designs look like. And there are load objectives - trying to become more efficient. How these factors are integrated into a rate design is discusses.

36333 (EPRI-CU–6332, pp. 3.1-3.20) **Tariffs used for load management in Europe.** de Voghel, L. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The tariff systems for the countries represented on the Group of Experts as a whole include provisions which, to varying degrees, encourage customers who are able to do so to modify their load curves so as to allow the electricity producer and distributor to balance electricity supply and demand at the lowest cost. The description of the various tariff systems has been discussed in many previous UNIPEDE studies which the Group of Experts was able to use. In particular the reports should be mentioned of the Working Groups chaired by Mr. Massani (Electricity Load Modulation and Tariffs, 1982) and by Mr. Garzenini (Interactions Between Metering Techniques, Load Control, Meter Reading and Billing, 1982), and of the various contributions made to the Tariffs Conference in Helsinki in 1984. Rather than carrying out a detailed new description of the tariff provisions used for load management in each country, a comparative analysis is presented. After stating the principles of these provisions, main forms taken by their implementation in each country, according to the specific context of each are presented. Finally, an attempt is made to bring out the changing trends in these methods of load management using tariffs.

36334 (EPRI-CU–6332, pp. 4.1-4.50) **Comparison of time-of-use rate impacts.** Faruquil, A. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Some of the insights are presented that have come out of many years of EPRI research on the topic, How do American customers respond to time-of-use (TOU) rates? Much of the information can be categorized as the result of one of three different types of analysis: (1) a historical analysis, that is, analysis of data that has been collected on customers who are on these rate structures in a normal setting; (2) an experimental analysis of situations that were artificially controlled to obtain more precise estimates of customer response; or (3) a simulation analysis of industrial and commercial processes which tries to capture technological possibilities that have not yet been observed but could prevail in the near future. Some results dealing with residential customers are presented. These results were obtained from a series of pricing experiments that were conducted during 1975-1982 across the country by many utilities in conjunction with the Department of Energy (DOE) and the relevant state regulatory bodies. Sixteen experiments were conducted, and out of these EPRI selected the top nine for more detailed analysis. Subsequently, only the top five were analyzed - Southern California Edison, Wisconsin Public Service, Carolina Power and Light, Connecticut Power and Light, and the Los Angeles Department of Water and Power. These analyses are discussed.

36335 (EPRI-CU–6332, pp. 5.1-5.25) **Cost-based pricing in the United States.** Hanser, P. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Issues having to do with rate design and interruptible/curtailable (I/C) rates are discussed. This is in part based on a research project that EPRI performed which looked at several (close to a hundred) industrial interruptible/curtailable customers throughout the United States, scattered among ten or eleven utilities. Some cost pricing issues that are yet to be resolved are presented. One of them is called dynamic operating benefits; a second one cost allocation; and the third is an introduction to something known as optimal nonuniform pricing. Interruptible and curtailable rates are fairly well known. With an I/C rate the firm agrees to curtail, or lower, its power level - lower its level of demand - to something that has been labeled the firm power level. There are some distinctions that are sometimes made in the United States between interruptible and curtailable rates; also, depending on the utility, they are sometimes reversed. In some utilities, interruptible customers have their entire load interrupted and in others, only a partial load. Curtailable customers tend to have partial interruptions for most utilities. The factors that affect cost-based pricing in the USA are discussed.

36336 (EPRI-CU–6332, pp. 6.1-6.21) **Marginal cost pricing in France.** Fouquetl, D. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The constant adaptation between electricity supply and demand can be achieved in two ways: on the supply side, through the construction of additional facilities, and on the demand side by implementing tariffs, load management schemes, and a commercial policy. Changes in demand clearly imply changes in the supply system in terms of both the installed capacity and the operating conditions of the system which need to be taken into account. There are two main principles underlying the French electricity pricing policy: equality of treatment and economic efficiency. Equality of treatment means that all customers with the same characteristics of use pay the same price, or, in the case of systems with options, that they have the same tariff options. This principle allows wide tariff differentiation. Indeed, with regard to the importance or the nature of the services they imply, there is a great difference between a kWh supplied at a very high voltage to an industrial customer and a kWh supplied at a low voltage to a domestic customer. For the community, the principle of economic efficiency leads to selling electricity at its marginal cost, which is the cost to the community of a customer who decides to consume an additional unit of a good.

36337 (EPRI-CU–6332, pp. 7.1-7.3) **Discussion on planning and pricing.** Larsson, G. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Planning is changing at utilities. The facts that are (and should be) taken into account in the planning process are discussed. The role of cost in the development of resource and pricing plans is described. The emergence of least cost planning has been a challenge to the utility planners, but also something that was much needed and which will lead to better over-all plans. The increasing

role of regulation has changed the way utilities approach the planning process; specifically, in the increasing use of planning models that require large amounts of data. Least cost planning has been debated, but not fully understood. No one has a comprehensive, concise definition of least cost planning. This may not be possible at this time because least cost in the long run may not yield anything near least cost in the short run; so the time frame is important. There is no consensus about the appropriateness of using least cost planning in making pricing decision. Making utilities publicly accountable for their long-term planning has been useful for the utilities, albeit painful. It has also been painful on the regulatory side to some extent, since regulators are also now being held accountable for their actions.

36338 (LBL–27130) **Least-cost planning in the utility sector: Progress and challenges.** Goldman, C.; Hirst, E.; Krause, F. (eds.). Lawrence Berkeley Lab., CA (USA); Oak Ridge National Lab., TN (USA). May 1989. 38p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098;AC05-84OR21400. (ORNL/CON–284). Order Number DE89013768/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This study reviews recent progress in least-cost planning throughout the US and identifies the need for additional work in relevant areas. Although this study was commissioned by DOE to help develop DOE funding priorities, the recommendations presented here go far beyond what DOE's budget can afford. We hope that utilities, their research institutes, and other organizations will use this report in setting their priorities for future work on least-cost planning. Based on the detailed assessments presented in this report, we suggest several foci for long-term LCUP efforts nationwide. Because current rate-of-return regulation rewards utilities for increasing short-term sales, perhaps the most important of these topics is the development of financial incentives for utilities (and their shareholders) to implement least-cost plans. 49 refs., 4 figs., 3 tabs.

36339 (MPUB–99/89) **Manitoba Hydro application for an order requesting a general rate review and approval of certain rate adjustments effective April 1, 1989.** Manitoba Public Utilities Board, Winnipeg, MB (Canada). 1989. 35p. (CE–02662). Available from Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, MB, Canada R3C 3L6; $5.00 CAN.

This report presents the results of a hearing before the Board to review and approve rate adjustments. The report presents information on the background to the general rate application; the revenue requirements of Manitoba Hydro for its financial objectives, financial forecasts, foreign exchange, pension costs, self insurance, control of expenses, the Manitoba Energy Foundation Act, and the Energy Rate Stabilization Act; and the costs of service relating to load research, generation, and transmission costs, the definition of cost, the inclusion of export customers, and rates. The position of the intervenors is summarized. A number of recommendations relating to the financial operation of Manitoba Hydro are given, as well as an increase in general consumer rates of 5%, and methods of reduction in revenue for various other categories. Revenue rates for residential, small, and medium general service, and streetlighting are given in an appendix.

36340 (PNL-SA–17006) **Experiences with a large load research project in the Pacific Northwest: ELCAP [End-Use Load and Consumer Assessment Program].** Gillman, R.A.; Sandusky, W.F.; Patton, J.E.; Hauser, S.G. Pacific Northwest Lab., Richland, WA (USA). May 1989. 19p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. (CONF-8905123–2: End use load information and application conference, Syracuse, NY, USA, 16-17 May 1989). Order Number DE89014457/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Bonneville Power Administration (Bonneville) began the End-Use Load and Consumer Assessment Program (ELCAP) in August, 1983, to support demand side planning, forecasting, and demand side program development and delivery. This project, conducted for Bonneville by the Pacific Northwest Laboratory (PNL), which is operated for the Department of Energy by the Battelle Memorial Institute, involves the collection and analysis of hourly end-use electricity usage data together with detailed characteristics from approximately 400 residences and 100 commercial buildings in the Pacific Northwest. The purpose of this paper is to relate our experiences with the ELCAP from its early days to its current status. This paper will explore Bonneville's and PNL's experiences ranging from project formulation to technology development to current management issues. We will specifically cover knowledge gained from the development of data loggers, loggers installation, measurement protocols, and data quality assurance. Additionally, the more global issues associated with managing the ELCAP and maintaining agency support in a time of cost-consciousness will be discussed. These issues include the areas of budgets, perceptions, producing useful results, and data availability. 3 refs.

2980 Consumption and Utilization

Refer also to citation(s) 35648, 36227, 36258, 36405, 36406

36341 (DOE/EIA–M033(87)) **Documentation for the State Energy Data System 1960–1987 diskettes.** USDOE Energy Information Administration, Washington, DC (USA). May 1989. 12p. Sponsored by DOE Management & Administration. Order Number DE89014433/JAW. Available from NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.

The State Energy Data System (SEDS) Diskettes contain data from the publication "State Energy Data Report, Consumption Estimates, 1960–1987." The state data are grouped by Census Region with one region per diskette. In addition to the states in the Census Region, each diskette contains data for the United States. Also included on the diskettes are two utility programs which will format the data for use by the most widely used spreadsheet and data base software products.

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 35906

36342 (EPRI-CU–6332, pp. 11.1-11.14) **Research in photovoltaics.** Schaefer, J. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The issues involved in applying photovoltaic (PV) to the electricity supply problem are discussed. There is some interest in the electric utility industry in the United States in photovoltaics not only as a supply option, but also as a demand reduction option. The economic issues in PV, future prospects far decreased costs, and field test results of line-connected US PV systems are discussed. It is concluded that the technical feasibility of these systems has been demonstrated, the widespread uses now for PV applications are in remote areas, costs are still too high for bulk power supply, and all technologies are potentially cost-effective.

36343 (EPRI-CU–6332, pp. 11.15-11.24) **Status of photovoltaics for commercial power generation.** Schaefer, J.C. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Consulting Services, Berkeley, CA (USA). Apr 1989. (CONF-8804269–: International workshop on innovative DSM techniques, Palo Alto, CA, USA, 5-6 Apr 1988). In *International workshop on innovative DSM (demand-side management) techniques. Proceedings.* Order Number DE89011265/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Photovoltaic power generation is perhaps the simplest mechanism known for generating electricity. The process generates direct current from sunlight, using cells that consist of a chemically treated semiconductor material - usually silicon. Each cell typically provides less than a volt and less than one ampere so they are wired in series to get more voltage and in parallel to get more current. Manufacturers produce modules ranging in size up to 20 square feet. Sunlight is a very diffuse source of energy - only about a kilowatt per square meter is available on a bright, sunny day - so large collector areas are required to generate commercially useful quantities of electricity. This fact has important implications for photovoltaics'

applications, and because it would not be cost effective to repair large area systems it also places severe requirements on the reliability of the cells and interconnections in a photovoltaic (PV) system. Experience over the past 10 years demonstrates that these systems have become extremely reliable, which is one reason for the great interest shown not only by individuals but also by institutions such as electric utilities. The commercial uses of these systems, cost, field test results, and outlook for PV supply are discussed.

36344 (NEI-DK–172) **Decentral dual-purpose power plants.** Teknologiraadets Styregruppe for Vedvarende Energi, Copenhagen (Denmark). Nov 1987. 90p. (In Danish). (CONF-8710469–: Conference on decentral dual-purpose power plants, Moltkes Palae, Denmark, 26 Oct 1987). Order Number DE89776141/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

The purpose of the conference was to elucidate, and produce suggestions for methods of solving, problems concerning the use of renewable energy sources in relation to decentral dual-purpose power plants in Denmark. (AB).

30 DIRECT ENERGY CONVERSION

3001 MHD Generators

Refer also to citation(s) 36918

36345 (DOE/ET/15601–30) **Diagnostic development and support of MHD test facilities: Progress report, July–September 1987.** Shepard, W.S.; Cook, R.L. Mississippi State Univ., Mississippi State, MS (USA). MHD Energy Center. Oct 1987. 58p. Sponsored by DOE Fossil Energy. DOE Contract AC02-80ET15601. Order Number DE89013110/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Mississippi State University is developing diagnostic instruments for MHD power train acquisition and for support of MHD component development test facilities. Microprocessor-controlled optical instruments, initially developed for HRSR support, are being refined, and new systems to measure temperatures and gas-seed-slag stream characteristics are being developed. To further data acquisition and analysis capabilities, the diagnostic systems are being interfaced with MHD Energy Center computers. Additionally, technical support of the diagnostic needs of the national MHD research effort is being provided. 10 refs., 23 figs.

36346 (DOE/PC/90274–T1) **MHD Integrated Topping Cycle Project: Quarterly progress report, 30 September–31 October 1987.** TRW Space and Technology Group, Redondo Beach, CA (USA). Jan 1989. 26p. Sponsored by DOE Fossil Energy. DOE Contract AC22-87PC90274. (MHD-ITC–89-001). Order Number DE89014126/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The overall objective of the project is to design and construct prototypical hardware from an integrated MHD topping cycle, and conduct long duration proof-of-concept tests of the integrated system at the US DOE Component Development and Integration Facility in Butte, Montana. The results of the long duration tests will augment the existing engineering design data base on MHD power train reliability, availability, maintainability and performance, and will serve as a basis for scaling up the topping cycle design to the next level of development, an early commercial scale power plant retrofit. Progress is reported on the design, fabrication, and testing of components of the MHD power train. 1 fig.

36347 (DOE/PC/90274–T2) **MHD Integrated Topping Cycle Project: Third quarterly progress report, 1 February–30 April 1988.** TRW Defense and Space Systems Group, Redondo Beach, CA (USA). Applied Technology Div. Jan 1989. 25p. Sponsored by DOE Fossil Energy. DOE Contract AC22-87PC90274. (MHD-ITC–89-003). Order Number DE89014130/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The overall objective of the project is to design and construct prototypical hardware for an integrated MHD topping cycle, and conduct long duration proof-of-concept tests of the integrated system at the US DOE Component Development and Integration Facility in Butte, Montana. The results of the long duration tests will augment the existing engineering design data base on MHD power train reliability, availability, maintainability, and performance, and will serve as a basis for scaling up the topping cycle design to the next level of development, an early commercial scale power plant retrofit. This quarter, work continued on planning, and design, fabrication and testing of the components of the MHD power train.

36348 (DOE/PC/90274–T3) **MHD [Magnetohydrodynamics] Integrated Topping Cycle Project: Second quarterly technical progress report, November 1, 1987–January 31, 1988.** TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div. Jan 1989. 27p. Sponsored by DOE Fossil Energy. DOE Contract AC22-87PC90274. (MHD-ITC–89-002). Order Number DE89014129/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The overall objective of the project is to design and construct prototypical hardware for an integrated MHD topping cycle, and conduct long duration proof-of-concept tests of the integrated system at the US DOE Component Development and Integration Facility in Butte, Montana. The results of the long duration tests will augment the existing engineering design data base on MHD power train reliability, availability, maintainability, and performance, and will serve as a basis for scaling up the topping cycle design to the next level of development, an early commercial scale power plant retrofit. Progress results towards the design, fabrication and testing of the components of the MHD power train are reported. 1 fig.

36349 MHD bottoming cycle component testing at the coal fired flow facility - 1987. Attig, R.C. (The Univ. of Tennessee Space Institute, Tullahoma, TN (US)); Muehlhauser, J.W.; Johanson, N.R.; Sanders, M.E. v.v of 26th symposium on engineering aspects of magnetohydrodynamics. Muehlhauser, J.W. University of Tennessee Space Institute, Tullahoma, TN (1988). (CONF-880647–: 26. symposium on engineering aspects of magnetohydrodynamics, Nashville, TN, USA, 20-22 Jun 1988).

During the period covered by this status report, four tests were conducted at the DOE Coal Fired Flow Facility. Much of this time is proof-of-concept testing aimed primarily at evaluating superheater and intermediate temperature air heater tube materials behavior and fouling of tube bank surfaces. The performance of other components, especially the baghouse and electrostatic precipitator, is also being evaluated. The report also describes component and facility modifications and improvements made during this period. One significant observation made during the period was the effect of seed to coal sulfur ratio on fouling and performance of the particulate collection equipment. Fouling was noted to be significantly less when there was a slight deficiency of potassium to react with all to the sulfur. Performance of the particulate collection equipment was also better. The performance of the ESP was also determined at two gas flow rates. Gas temperatures at the superheater test sections were sufficiently high to melt potassium sulfate.

36350 Coal-fired MHD topping cycle test progress at the component development and integration facility. Funk, G. (MSE, Inc., Butte, MT (US)); Hart, A.; Stepan, I. v.v of 26th symposium on engineering aspects of magnetohydrodynamics. Muehlhauser, J.W. University of Tennessee Space Institute, Tullahoma, TN (1988). (CONF-880647–: 26. symposium on engineering aspects of magnetohydrodynamics, Nashville, TN, USA, 20-22 Jun 1988).

Recent testing emphasized characterizing iron oxide injection into the CFC and obtaining baseline data for eastern coal (Illinois #6). Sufficient data was collected on the iron oxide test series to confirm the beneficial affects of iron oxide with western coal on cathode wall shorting. In addition, data showed iron oxide injection, in general, does not produce significant improvement in power output. Eastern coal, in conjunction with the iron oxide, produced a significant increase in conductivity and some increased power level. The open circuit voltage remained at the same level as recent western coal tests, while significant increases in closed circuit current were observed. Iron oxide injection with eastern coal did not produce the significant beneficial affects on the cathode wall shorting that it did with western coal.

36351 Experimental investigation of factors affecting the cathode wall slag layer resegmentation frequency. Pian, C.C.P.

(Avco Research Lab., Inc., Everett, MA (US)); Petty, S.W.; McClaine, A.W. v.v of 26th symposium on engineering aspects of magnetohydrodynamics. Muehlhauser, J.W. University of Tennessee Space Institute, Tullahoma, TN (1988). (CONF-880647–: 26. symposium on engineering aspects of magnetohydrodynamics, Nashville, TN, USA, 20-22 Jun 1988).

A series of generator experiments was carried out to investigate the functional dependencies of the cathode wall slag layer resegmentation frequency upon gasdynamic and generator characteristics. Variations in gas conductivity, magnetic field intensity, Hall parameter, current density, and electric field intensity were investigated to establish which generator parameter(s) affects the cathode slag shorting patterns. The validity of three proposed models for 3 lag layer resegmentations are tested by comparisons with measured data. The generator test results, showing that the cathode nonuniformity patterns are only a function of the Hall voltage, suggest that the high voltage inter-cathode gaps might be created by axial leakage currents and maintained by arcs. The voltage across the open gap is characteristic of an arc voltage.

36352 On the nature of slag chemistry in an MHD generator. Rosa, R.J. (Montana State Univ., Bozeman, MT (US)); Pollina, R.J.; Farrar, L.C. v.v of 26th symposium on engineering aspects of magnetohydrodynamics. Muehlhauser, J.W. University of Tennessee Space Institute, Tullahoma, TN (1988). (CONF-880647–: 26. symposium on engineering aspects of magnetohydrodynamics, Nashville, TN, USA, 20-22 Jun 1988).

A progress report is provided on an exploratory study, supplemented by limited experimental data, to establish the influence of slag composition on the MHD generator performance. From the results obtained to date it can be concluded that detailed analysis of the slag composition can be useful in evaluating coal-fired MHD generator performance. Electrical losses of the generator have been coupled to axial current leakage, which to a large extent is due to the electrical nature of the slag. The slag electrical behavior is dominated by the relative values of ionic to electronic current transport - especially on the cathode wall. The influence that metallic phases of iron and potassium, in conjunction with a percolation type of current transport are introduced as a way to interpret slag current leakage mechanisms.

36353 Strategies for combatting problems caused by cathode slag shorting. McClaine, A.W. (Avco Research Lab., Inc., 2385 Revere Beach Parkway, Everett, MA (US)); Pian, C.C.P.; Petty, S.W.; Pakko, J.D.; Schmitt, E.W. v.v of 26th symposium on engineering aspects of magnetohydrodynamics. Muehlhauser, J.W. University of Tennessee Space Institute, Tullahoma, TN (1988). (CONF-880647–: 26. symposium on engineering aspects of magnetohydrodynamics, Nashville, TN, USA, 20-22 Jun 1988).

During the long duration testing in the Avco Mk VII generator (which has demonstrated over 1300 hours of duration on the Avco anode designs), excessive corrosion on the cathode edges of the insulator walls was observed. This corrosion has been correlated with the high voltages on inter-cathode insulators resulting from the inter-electrode shorting of neighboring cathodes. This paper presents a description of the problem and describes the results of three strategies for controlling this problem. The first strategy is an on-going experimental investigation in which materials and designs for insulator wall elements are being explored. The second strategy uses slag chemistry modifications to reduce inter-cathode shorting and the resulting inter-cathode voltages. The third strategy is aimed at understanding the nature of the cathode wall shorting phenomena and using this understanding to develop other methods for controlling the magnitude of the inter-cathode voltages.

36354 Voltage-current characteristics of the insulator gaps in a slagging MHD generator. Pian, C.C.P. (Avco Research Lab., Inc., 2385 Revere Beach Parkway, Everett, MA (US)); Sadounik, I.; Petty, S.W.; McClaine, A.W.; Pakko, J.D. v.v of 26th symposium on engineering aspects of magnetohydrodynamics. Muehlhauser, J.W. University of Tennessee Space Institute, Tullahoma, TN (1988). (CONF-880647–: 26. symposium on engineering aspects of magnetohydrodynamics, Nashville, TN, USA, 20-22 Jun 1988).

The voltage-current characteristics of inter-element insulators have been measured during slagging generator tests in the Avco Mk VII facility. These measurements were made to determine the leakage resistances of the slag covered inter-electrode and inter-peg insulators, and to identify possible mechanisms for the resegmentation of the cathode wall slag layer. The V-I measurements were made for anode, cathode, and sidewall insulator gaps, and for cold and semi-hot electrode designs. The effects of magnetic field and slag doping were also investigated. An interpretative analytical model, based on an equivalent network formulation, was developed to reduce the test data and to determine the amounts of leakage current across the insulators.

36355 Coal-fired MHD power train performance test results. Solbes, A. (Applied Technology Div., TRW Space and Technology Group, Redondo Beach, CA (US)); Ogle, G.J.; Myrick, S.; Petty, S.W.; Pian, C.C.P.; Farrar, L.C. v.v of 26th symposium on engineering aspects of magnetohydrodynamics. Muehlhauser, J.W. University of Tennessee Space Institute, Tullahoma, TN (1988). (CONF-880647–: 26. symposium on engineering aspects of magnetohydrodynamics, Nashville, TN, USA, 20-22 Jun 1988).

Coal-fired MHD power train test activities at the Department of Energy's Component Development and Integration Facility (CDIF) have been conducted primarily for evaluation and improvement of generator performance. Test analyses have indicated that the following areas can impact the measured performance of the power train: 1) plasma conductivity, 2) plasma non-uniformity, 3) boundary layer voltage drop, and 4) current leakage in the slag layer. The test program in progress has been designed to investigate the effect of each of these mechanisms on channel power. Test hardware configuration changes and variations in operating conditions have been undertaken to characterize the power train performance.

36356 Status report of 1A test train hardware performance and development. Giovan, R.J. (Component Development and Integration Facility, MSE, Inc., Butte, MT (US)); Lee, Y.M. v.v of 26th symposium on engineering aspects of magnetohydrodynamics. Muehlhauser, J.W. University of Tennessee Space Institute, Tullahoma, TN (1988). (CONF-880647–: 26. symposium on engineering aspects of magnetohydrodynamics, Nashville, TN, USA, 20-22 Jun 1988).

A status report is presented on the performance and development of the 1A test train hardware at the Department of Energy's Component Development and Integration Facility (CDIF) from March 25, 1987, through March 25, 1988. Included in the report are the thermal and electrical performance of the coal-fired combustor (CFC), the two 1A channels, and the various special wall sections that make up the channels. The special wall sections include a refurbished platinum-capped anode wall, forward peg-style sidewalls, newly designed and fabricated cathode walls, and diagonal sidewalls refurbished with newly designed and fabricated cathode sidebars. The report also includes a status of the recently installed stainless steel capped, segmented, electrically isolated, second-stage nozzle for the CFC, and a discussion of the analytical techniques used during the analysis phase of the nozzle design.

36357 Materials tests in support of MHD steam bottoming plant. Natesan, K. (Argonne National Lab., Argonne, IL (US)); Swift, W.M. v.v of 26th symposium on engineering aspects of magnetohydrodynamics. Muehlhauser, J.W. University of Tennessee Space Institute, Tullahoma, TN (1988). (CONF-880647–: 26. symposium on engineering aspects of magnetohydrodynamics, Nashville, TN, USA, 20-22 Jun 1988).

Test data have been developed for the corrosion of several commercial ASME-coded alloys and their weldments by exposing internally cooled ring specimens to simulated MHD environments. The specimens, coated with a K_2SO_4-rich deposit, were exposed for times up to 2000 h at metal temperatures of 762 and 593^{0}C to simulate, intermediate-temperature air heater (ITAH) and transition region conditions, respectively. The gas temperatures in these tests were 982 and 816^{0}C, respectively. This paper discusses, in detail, the observed corrosion scale morphologies of various exposed specimens. Data on scale thickness, depth of intergranular penetration, and metal recession are presented and the results are used to assess the corrosion behavior of various materials for application in the MHD steam bottoming plant.

36358 Two dimensional modeling of fluid mechanics, heat transfer, and NO decomposition in the CFFF radiant furnace.

Crawford, L.W. (The Univ. of Tennessee Space Institute, Tullahoma, TN (US)); Lee, J.J.; Lineberry, J.T. v.v of 26th symposium on engineering aspects of magnetohydrodynamics. Muehlhauser, J.W. University of Tennessee Space Institute, Tullahoma, TN (1988). (CONF-880647–: 26. symposium on engineering aspects of magnetohydrodynamics, Nashville, TN, USA, 20-22 Jun 1988).

The results of computations of two dimensional, steady flow with heat transfer and chemical reactions in the CFFF radiant furnace is presented. Two dimensional gas dynamic modeling was used to analyze the recirculating flowfield of the furnace. This model has been used in past furnace studies and includes the effects of turbulence, compressibility, and radiative heat transfer. A kinetics model (the PROF code) which has been tailored for study of NO decomposition in the CFFF downstream test train was applied to results of the precomputed flowfield to obtain predictions of NO decomposition within the furnace. Application of the kinetics model was made along flowfield streamlines. The two-dimensional furnace heat transfer and gas dynamic calculations were used to specify velocity, pressure, and temperature distributions.

36359 **MHD plasma velocity measurement using correlation techniques.** Schiller, D. (Component Development and Integration Facility, Butte, MT (US)); Joyce, J.; Lofftus, D. v.v of 26th symposium on engineering aspects of magnetohydrodynamics. Muehlhauser, J.W. University of Tennessee Space Institute, Tullahoma, TN (1988). (CONF-880647–: 26. symposium on engineering aspects of magnetohydrodynamics, Nashville, TN, USA, 20-22 Jun 1988).

This paper reports the progress on development of a technique for measuring plasma velocity used in analyzing channel performance at the Component Development and Integration Facility (CDIF). Fluctuations of plasma properties (principally conductivity) influence external diagonal currents as the plasma passes electrodes along the MHD channel. Signals from current sensors on the diagonal links of the channel are recorded on analog tape and later digitized. Commercial microcomputer-based signal analysis software is used to estimate the time shift between current fluctuations on distant electrodes using cross correlation algorithms. The time shift is used with measured electrode separation to estimate average plasma velocity. Results presented here include time and power spectral density plots for link current data, cross correlation plots, and a tabular list of measured velocity values.

36360 **Cold flow modeling study of coal-fired MHD combustor.** Grove, A. (Applied Technology Div., TRW Space and Technology Group, Redondo Beach, CA (US)); Ubhayakar, S.K. v.v of 26th symposium on engineering aspects of magnetohydrodynamics. Muehlhauser, J.W. University of Tennessee Space Institute, Tullahoma, TN (1988). (CONF-880647–: 26. symposium on engineering aspects of magnetohydrodynamics, Nashville, TN, USA, 20-22 Jun 1988).

The characterization and visualization of the flow and mixing patterns in slagging MHD combustors is a valuable tool to help improve the design of existing combustor systems. Cold flow modeling is a convenient and expeditious way of characterizing the major flow patterns within a combustor and investigating design improvements. A 1/3 scale, transparent cold flow model of TRW's 50 MW_t MHD combustor has been developed for flow visualization studies. The modeling guidelines adopted for the design and operation of the cold flow model are presented as well as a description and photographs of the model hardware. Observations from initial cold flow studies are also included.

3005 Fuel Cells

Refer also to citation(s) 35861, 36223, 36650

36361 (DOE/IR/05106–T78) **On-site municipal fuel cell power plant: Feasibility and applications guide.** Urban Consortium for Technology Initiatives (USA). Energy Task Force. Dec 1986. 78p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG02-78IR05106. Order Number DE89013842/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Fuel cells represent a power source of the future. Though they have been experimented with for decades, their potential is just beginning to be utilized in applications that vary in size from multimegawatt power stations to one kilowatt units used in aerospace applications. Public utility and industrial power is currently being provided in a few cases by carefully monitored fuel cells. The Gas Research Institute and United Technologies Corporation, have also been conducting tests on flexible, modular 40 kilowatt on-site fuel cells. United Technologies Corporation is currently developing a 200 kilowatt unit. These latter on-site power generators may have applications in municipal operations. The city of Albuquerque has examined the performance record of the 40 kilowatt units and the projected performance of the 200 kilowatt units. Energy demands for several "typical" municipal facilities have also been studied. By comparing the cost of energy production from the fuel cells and the cost of conventional energy used by existing facilities, this report examines both the current and future feasibility of using fuel cells at several facilities. During the course of this project, an applications guide was developed by the Gas Research Institute and applied to the facilities examined in this study. 8 figs., 9 tabs.

36362 (LBL–27082) **Fuel cell technology in the United States.** Kinoshita, K. Lawrence Berkeley Lab., CA (USA). Apr 1989. 31p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-8905164–1: Seminar at Paul Scherrer Institute, Wurenlingen, Switzerland, 29 May - 7 jun 1989). Order Number DE89013430/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Fuel cells provide a new and exciting option for the efficient conversion of fossil fuels to electricity. Development of fuel- cell technology has been underway in the United States (US) for over 20 years, with the initial focus on space application (i.e., Gemini, Apollo). More recently, commercialization of fuel cells for utility power generation and transportation applications has received considerable attention in the US. The purpose of this paper is to summarize the status of fuel-cell technology in the US, where development of five major fuel cell systems are underway. 26 refs., 5 figs., 4 tabs.

36363 (PB–89-142616/XAB) **Improved acid electrolytes: synthesis and structure of fluorine-containing sulfonic acids for fuel cells. Final report, July 1987-August 1988.** Gard, G.L. Portland State Univ., OR (USA). Dept. of Chemistry. Sep 1988. 20p. Available from NTIS, PC A03/MF A01.

See also PB–87-235693.

Seven new ether-containing sulfonyl fluorides (precursors to sulfonic acids) were prepared from $I(CF_2)_2O(CF_2)_2SO_2F$ and unsaturated olefins/alkynes. Two new ether sultones were prepared. A more efficient route for preparing ether containing sulfonic acids has been discovered. Additional quantities of mono/di sulfonic acids have been prepared and evaluated by Dr. Ross. Significant results for fuel cell electrolytes have been achieved.

36364 (PB–89-173629/XAB) **Improved acid electrolytes for fuel cells. Final report, July 1985-January 1989.** Shreeve, J.M. Idaho Univ., Moscow, ID (USA). Dept. of Chemistry. Jan 1989. 38p. Available from NTIS, PC A03/MF A01.

See also PB–87-235685.

A large number of new acids and their precursors were synthesized and characterized, including four monophosphonics ((CF3)2CFP(O)(OH)2, H(CF2)2O(CF2)2P(O)(OH)2, H(CF2)4O(CF2)2P(OH)2, and (HO)2P(O)(CF2)4O(CF2)2H); two monosulfonics (CF3CF2O(CF2)2SO2OH:H2O and CF3(CF2)3O(CF2)2SO2OH:H2O); one disulfonic, HOSO2CF2CF2OCF2SO2OH; and three mixed phosphonic/sulfonics ((HO)2P(O)CF2SO2OH, (HO)2P(O)CFHSO2OH, and (HO)2P(O)(CF2)4O(CF2)2SO2OH). Two perfluoroalkyl phosphonic acids, the disulfonic acid and (HO)2P(O)CF2SO3H were synthesized in larger quantities for further testing as electrolytes or additives in fuel cells. The acids with ether linkages appear to exhibit good water solubility and superior activity for oxygen reduction compared to phosphoric acid when used as additives.

36365 (PB–89-173652/XAB) **Solid-oxide fuel-cell technology development. Annual report, May 1, 1987-April 30, 1988.** Ray, E.R. Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center. Dec 1988. 127p. (REPT–1273-12). Available from NTIS, PC A07/MF A01.

See also PB–88-133491.

Effort under the project is focused on successfully operating a tubular solid oxide fuel cell (SOFC) generator directly on pipeline natural gas without external reforming. A materials test loop and a highly instrumented test facility have been placed in operation. A 2000-hour single cell life test was successfully completed. Impregnation of both anode and module parts was demonstrated to minimize carbon deposition. Stable performance was demonstrated in two 36-cell bundle tests. A 3-kW module has been developed which can serve as the building block of larger modules. Studies were performed on potential SOFC generator users' requirements and applications to confirm competitive potential in industrial and cogeneration applications.

36366 The nature and composition of the passive film formed on Ni-P-Cr metallic glasses. Helfand, M.A. (Dept. of Materials Science and Engineering, State Univ. of New York at Stony Brook, Stony Brook, NY (US)); Clayton, C.R.; Sorensen, N.R.; Diegle, R.B. v.v of Proceedings of the Electrochemical Society fall meeting. Volume 88-2 (extended abstracts). The Electrochemical Society, Pennington, NJ (1988). (CONF-881061–: Electrochemical Society fall meeting, Chicago, Illinois, USA, 9-14 Oct 1988).

The presence of both Cr and P in transistion-metal metalloid glasses has been observed to promote the development of very stable, protective passive films. In order to investigate the interaction of Cr and P in the formation of passive films four alloy systems where chosen for study; Ni-20P, Ni-20P-3Cr, Ni-20P-6Cr and Ni-20P-10Cr. All the alloys were prepared by melt spinning and the glassy structure was confirmed by X-ray and electron diffraction, and by transmission electron microscopy. The authors have examined the anodic behavior and the composition of the passive film formed on these alloys in 0.2N HCl (pH=0.7) and 0.2N H_2SO_4 (pH=1.2) using electrochemical techniques and surface analysis (XPS and AES). A very interesting property of the glassy alloys containing P or P and Cr together is their insensitivity to Cl ion attack. The authors have speculated that this may be due to a cation selective effect which is induced by phosphate anions in the outermost portion of the passive film. Increasing Cr additions enhances this effect. The alloys exhibit wider passive potential regions and lower passive current densities as the Cr content is increased. A second interesting property of the Ni-P-Cr alloys is the composition and chemical make-up of the passive film. XPS results obtained from the surfaces of the polish-formed films and passive films on the glassy alloys show the polish-formed films to contain Cr_2O_3, which is considered by many to be the main passivating species of stainless steels.

36367 Impedance spectroscopy for the study of anodic copper dissolution in sulfuric acid in presence of benzotriazole. Clerc, C. (Dept. of Chemical Engineering, and Materials Research Lab., Univ. of Illinois, Urbana, IL (US)); Alkire, R.C. v.v of Proceedings of the Electrochemical Society fall meeting. Volume 88-2 (extended abstracts). The Electrochemical Society, Pennington, NJ (1988). (CONF-881061–: Electrochemical Society fall meeting, Chicago, Illinois, USA, 9-14 Oct 1988).

The presence of an anodic surface film dramatically affects the electrochemical behavior of dissolving electrode in processes like corrosion inhibition, passivity, electropolishing or pitting. The present study was initiated to learn more about the physical properties of the surface films present at the surface of a copper electrode during anodic dissolution in 0.5 SM sulfuric acid and 40 mM benzotriazole (BTA) at 25°C. This study is of practical importance because this organic compound is widely used for corrosion inhibition and as etching additive. The impedance spectra measured after 10 min of polarization (with a SOLARTRAN 1250 Frequency Response Analyzer and a SOLARTRON 1286 Electrochemical Interface) were analyzed by comparison with a physical model of the electrochemical interface in which the passive electrode is covered with a barrier layer. The main assumptions are that this barrier layer is a good electronic insulator of stoichiometric composition and that charge transfer reactions and double layer charging occur at both metal-barrier layer and barrier layer-electrolyte interphases. This model also considers the change in the barrier layer thickness under the influence of the applied potential. Least squares fitting of measured impedance spectra yield physical parameters of reasonable order of magnitude to support the proposed model. As predicted it was found that the barrier layer is itself covered by an outer porous film of corrosion products and that the metallic ions transfer through the barrier layer under high field conduction. By comparing the crystallographic lattice parameters and the dielectric constants of different copper compounds, the jump distance was determined to be about 5.5 A, indicating that the barrier layer is likely to be an hydrated copper sulfate ($CuSO_4$ $5H_2O$).

36368 The influence of surface capacitance on the measurements of localized corrosion transients. Isaacs, H.S. (Dept. of Applied Science, Brookhaven National Lab., Upton, NY (US)); Davenport, A.J. v.v of Proceedings of the Electrochemical Society fall meeting. Volume 88-2 (extended abstracts). The Electrochemical Society, Pennington, NJ (1988). (CONF-881061–: Electrochemical Society fall meeting, Chicago, Illinois, USA, 9-14 Oct 1988).

The difficulty of measuring the early stages of localized corrosion transients during pit growth, the repeated step growth in stress corrosion cracking or scratching, arises from the charging of the capacitance of the passive surface surrounding the actively corroding area. The charging of the surface delays the transmission of the potential during open circuit measurements or the current response of the potentiostat when under potential control. The effect of surface capacitance on the flow of current has been presented previously. At high frequencies (or short times) the low effective interfacial impedance makes electrodes behave as equipotential surfaces with very high current densities at the edges. The capacitance of the surface was also found to dominate potential transients when pits grew for a few seconds. The measurement of the kinetics of the early stages of pitting corrosion is an important aspect of the understanding of the process controlling the development of pits. Two approaches have been used to separate the contributions of the surface impedance to the observed transients. The first was the measurement of signal transmission along metal surfaces. The second was a computer simulation of the processes. The measurement of signal transmission was made with wire electrodes under potentiostatic control. An alloy 600 wire was supported in a tubular cell with the tip of one reference electrode positioned at various distances along the wire. A second reference electrode and an exposed wire tip auxillary electrode was placed at a fixed position close together near one end of the wire. These electrodes were used to produce a local single rectangular potential transient on the wire and the second reference electrode was used to monitor the propagating pulse along the wire.

36369 Measurements of the structure and dynamics of thin film growth on electrode surfaces by SHG. Richmond, G.L. (Chemical Physics Institute, Univ. of Oregon, Eugene, OR (US)); Shannon, V.L.; Koos, D.A. v.v of Proceedings of the Electrochemical Society fall meeting. Volume 88-2 (extended abstracts). The Electrochemical Society, Pennington, NJ (1988). (CONF-881061–: Electrochemical Society fall meeting, Chicago, Illinois, USA, 9-14 Oct 1988).

Over the past five years, research in this laboratory has focussed on the use of optical second harmonic generation (SHG) in probing interactions at the solid/liquid interface. The studies have provided valuable information about the sensitivity of SHG to such phenomena as molecular and ionic adsorption at smooth electrode surfaces, oxidative film formation, underpotential deposition processes, oxide formation and the dynamics of adsorption. More recently, our studies have focussed on the use of SHG to probe electrode surface structure and symmetry by the anisotropy in the SH response as the crystalline electrode is rotated about its surface normal. This talk summarizes recent results in this area for which the structure and dynamics of underpotentially deposited monolayers on crystalline metal surfaces are monitored in situ. Deposition of a monolayer or submonolayer of these foreign metals is intrinsically controlled by the change in the work function of the surface as the overlayer grows in a stepwise manner. Because of its proven sensitivity to surface structure, reconstruction and thin film growth, SHG is an attractive technique to investigate the processes occurring during lattice formation at the metal/metal interface in solution. The studies described here are Ag(111)/Pb, Ag(111)/Tl, Ag(110)/Tl, and Cu(111)/Tl. The results for the Ag(111)/Tl system are described to provide an example of the type of information which is obtainable.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

Refer also to citation(s) 35868

36370 (ORNL/CON–283) **Conservation and Renewable Energy Program bibliography, 1989 Edition.** Vaughan, K.H. Oak Ridge National Lab., TN (USA). Jun 1989. 182p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE89013769/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This bibliography lists reports and papers published under the Oak Ridge National Laboratory Conservation and Renewable Energy Program from 1980 through February 1989. Most of the documents in the bibliography are available from Oak Ridge National Laboratory. Documents not available from Oak Ridge National Laboratory are footnoted and the source is given. Items may also be purchased from the National Technical Information Service, or obtained directly from the publisher, libraries, or other information service.

3201 Buildings

Refer also to citation(s) 35865, 35931, 36197, 36214, 36217, 36255, 36307, 37024, 37025

36371 (BCH–8809) **Village energy retrofit of electric domestic water heating in a B.C. Hydro diesel generating area.** British Columbia Hydro, Vancouver, BC (Canada). 1988. 32p. (MICROLOG–89-01977). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In 1987, B.C. Hydro, with financial assistance from Energy, Mines and Resources (EMR) Canada, supplied and installed over 2000 insulating blankets on electric water heaters, in B.C. Hydro's diesel generation areas. Shower restrictors and tank thermostat turndowns were also offered. Monitoring of the electrical consumption of the serviced homes indicated an average reduction of 950 kWh/y due to the blanket. One new home was upgraged to energy efficient standards. An electrically heated office building was retrofitted with air source heat pumps, and a number of simple energy saving devices and modifications to reduce electricity consumption were incorporated into the building. There was consequently a 25% reduction in both energy consumption and peak demand. Without EMR's contribution, the payback period of the program is three years. As a result, B.C. Hydro extended the domestic water heater energy conservation program to its hydro-electric grid area. In conclusion, it appears that the success of a utility-directed community-level conservation program depends on a commitment by managment at the community level, on aggressive promotion (at the personal level if necessary), and on well-informed contractors. 10 refs., 3 figs., 6 tabs.

36372 (BCH/RC–438-U-SOA) **Residential domestic water heating advisory computer program. Vol. 2, computer user's guide. Vol. 3, programmer's guide.** McClelland, L.A. British Columbia Hydro, Vancouver, BC (Canada). Residential and Commercial Energy Management. 1987. 55p. (CE–02635). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The WATERHTG computer program was developed to aid in the marketing and customer advisory efforts of the Canadian Electrical Association member utilities. It produces an analysis of residential water heating costs with varying fuels and temperatures as well as presenting economic comparisons between purchased heaters and rental units where utility lease programs are available. The program is divided into three levels. This document gives information on analysis levels, distribution diskette files, hardware requirements, customer and utility screen options, and programming modifications for both computer users and programmers.

36373 (BCH/RC–438-U-SOA) **Residential domestic water heating advisory computer program. Vol. 1, technical report.** McClelland, L.A. British Columbia Hydro, Vancouver, BC (Canada). Residential and Commercial Energy Management. 1987. 31p. (CE–02634). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

A project was initiated to develop a computer package to assist in the marketing and customer advisory efforts of the Canadian Electrical Association member utilities. The program called WATERHTG produces an analysis of residential water heating costs with various fuels and temperatures as well as presenting economic comparisons between purchased heaters and rental units where utility lease programs are available. The program provides for the analysis of domestic water heating systems on three levels, with multiple levels of detail provided to handle different enquiry situations. A level 1 analysis, representing average household systems, is used for marketing estimates and general customer enquiries; level 2, providing detailed modelling of the storage tank heater, is most useful for enquiries regarding heater comparisons and selection; and level 3, the most detailed, models water use patterns and is therefore able to analyze the effect of appliance changes and varying hot water use. The work performed began with a literature search of existing water heater reports on modelling methods and monitoring results. Previous modelling was expanded upon with the aid of the located literature to obtain improved performance estimates for storage tank water heaters. In addition, 80 homeowners were surveyed to determine detailed water use patterns according to appliance usage and the surveys were used to develop a hot water usage algorithm based on family size and other factors. 9 refs., 6 figs., 3 tabs.

36374 (BFR-R–81-1988) **Conversion of detached houses with direct electric heating to district heating.** Kellner, J.; Nilsson, R.; Wikander, G.R. Swedish Council for Building Research, Stockholm (Sweden). 1988. 35p. (In Swedish). Order Number DE89776238/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Initial outline design has been carried out to investigate the factors involved in converting estates of houses having direct electric heating to low-temperature district heating. An area of two-story terrace houses in Upplands Vaerby, and another of single-story linked houses in Nacka, both in Stockholm county, have been chosen as application examples. Airborne heating has been selected as the main method for internal distribution. Warm air is blown into rooms by registers in rear walls. Existing electric heaters are retained, although with greatly reduced output power, to prevent cold downdraughts during the very coldest times of the year and as a safety measure. As far as Stockholm county is concerned, the method is felt to be able to provide a potential benefit, in the form of a reduction in the requirement for electrical energy for heating and an increase in the heat sink for production of back-pressure power, of about 1.2 TWh/year, equivalent to about 7% of the counties total consumption of electricity. In order to obtain practical experience of the introduction of this method in good time, it is important that full-scale demonstration project is carried out. (authors).

36375 (CONF-890609–5) **Contamination of reflective foils in horizontal applications and its effect on thermal performance.** Cook, J.C. Jr.; Yarbrough, D.W.; Wilkes, K.E. Oak Ridge National Lab., TN (USA). 1989. 20p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From ASHRAE annual meeting; Vancouver, Canada; 24-28 Jun 1989. Order Number DE89013047/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The increase in the emittance of aluminum foils due to measured amounts of laboratory dusting has been measured. These data and emittance measurements for specimens of horizontally positioned aluminum foil, taken from seven residential attics three to five years after installation, are reviewed. Modeling of the heat transfer across attic air spaces bounded by aluminum foil provides predictions of the increase in heat flow with increased surface emittance. 10 refs., 5 figs., 5 tabs.

36376 (DOE/CE–0263) **Bibliography of the DOE building equipment research program.** USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (USA).

Building Equipment Div. Dec 1988. 164p. Sponsored by DOE Conservation & Renewable Energy. Order Number DE89013871/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The Energy Conversion Equipment Program (ECEP) sponsors research directed at improving the efficiency of conversions equipment that uses conventional energy sources (primarily natural gas, oil, coal or electricity). Implementation of the efficiency improvements resulting from this research has the potential of saving 5.3 Quads of energy or about 10 percent of all the projected energy used in buildings in the United States in 2010. The mission of the ECEP is to increase the energy efficiency of building equipment by conducting long-term, high risk, generic research to advance the technical understanding of the basic energy use phenomena in both residential and commercial building equipment. The goal of ECEP research is to develop a technology that the private sector can draw upon for future development of energy efficient building equipment for improved utilization of scarce energy resources. The objectives of the program are: to develop an understanding of the inherent efficiency limits of conventional building equipment; to establish the feasibility of advanced technologies which can significantly improve energy utilization; and to develop the technology to a state of readiness where it can be used by others in design and utilization of present and future building systems. Program efforts are focused on generic technology-based research and development in which the private sector is not likely to engage because of limited resources, the high risk factors involved, and the long-term efforts required. Program elements are coordinated with national laboratories, universities, and private organizations such as the Electric Power Research Institute and the Gas Research Institute.

36377 (DOE/IR/05106–T68) **Financial options for energy efficiency: A program to reduce the energy cost burden on low income residents.** Urban Consortium for Technology Initiatives (USA). Energy Task Force. Jan 1983. 87p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG02-78IR05106. Order Number DE89013832/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

A significant proportion of New Orleans' residents have incomes below poverty level and often rent living quarters in houses which were built over eighty years ago. Original building designs often included passive cooling elements such as high ceilings, functioning transoms, shutters, overhangs and proper site orientation. Subsequent modifications which include installation of air conditioning, lowered ceilings and security devices have negated many of the effects of the original passive design features. Infiltration is also a significant problem during both heating and cooling seasons. Increasing utility costs coupled with recent reductions in energy cost assistance programs impose a severe stress on residents with lower incomes. A potential solution to these increasing cost burdens was to combine simple physical weatherization techniques with more efficiency in the use of energy in the home. This project sought to demonstrate the effectiveness of low cost and no cost weatherization techniques in New Orleans and to illustrate that such investments can be recovered in a short period of time through reduced energy bills.

36378 (DOE/OR/21697–1) **Thermal properties of wood and wood panel products for use in buildings.** TenWolde, A.; McNatt, J.D.; Krahn, L. Forest Service, Madison, WI (USA). Forest Products Lab. Jun 1988. 42p. Sponsored by DOE Energy Research. DOE Contract AI05-87OR21697. Order Number DE89014125/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report provides a review and evaluation of currently available information on the thermal conductivity and specific heat of wood building materials. We derived a linear equation for thermal conductivity of solid wood as a function of density and moisture content from data in the literature and used this to provide estimated conductivity values for various types of hardwoods and softwoods. Far fewer data exist for the thermal conductivity of wood panel products. Current design values appear to be based on the premise that the conductivity of plywood is the same as that of solid wood of the same species, but the few reported results from the measurements indicate a lower conductivity. More definite information exists on the conductivity of conventional particleboard and fiberboard, but additional conductivity measurements of plywood and some of the most commonly used flakeboards, such as oriented strandboard (OSB), are needed. Additional measurements of the specific heat are needed for all wood panel products. We discuss the special problems of measuring thermal properties of wood products with high moisture contents and the practical relevance of such data to building design and performance, and we conclude that thermal properties above fiber saturation are of little practical significance. The report contains the authors' recommendations for design values for thermal properties and for further research and additional measurements, as well as a bibliography. 33 refs., 14 figs., 10 tabs.

36379 (DOE/SF/17714–T1) **[Weatherization assistance program]: Annual report.** Ackco, Inc., Boulder, CO (USA). 26 Jun 1989. 31p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC03-88SF17714. Order Number DE89014122/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This annual report focuses on the twenty subgrantees that were monitored by ACKCO, Inc. from September 30, 1988 to September 29, 1989. In the following analysis, ACKCO, Inc. will proceed from the general to the specific; that is from: generic findings (weaknesses) among the 20 subgrantees; to summary of findings by State at the subgrantee level; to recommendation for technical assistance by Region and State; and to price analysis of weatherization materials purchased by region, State and subgrantee.

36380 (ETDE/CA-MS–8903) **Remote and northern energy-efficient house design catalogue.** Department of Energy, Mines and Resources, Ottawa, ON (Canada). Remote Community Demonstration Program. 1989. 126p. (CE–02649). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $ PRICES UPON REQUEST, FUNDS CAN.

This catalogue documents the design and construction of energy-efficient housing in Canada's northern and remote regions. The first part of the catalogue is a primer of construction and design principles, including regional and local considerations for northern housing; the requirements of design and construction details suited to severe climates; heating and ventilation system options; and different options for improving the energy-efficiency of existing homes. The second part offers a variety of energy-efficient house designs and construction techniques. Each original design includes a floor plan, general information on construction and operation, performance information if available, specific features and details, cost of materials and construction, and a review by the residents. Retrofit projects are described with their history, with the costs and paybacks given. A glossary is also included. 54 figs.

36381 (ITL–8509, pp. 475-479) **OPENSOL. Software for the optimization of sizing and control of complex heating systems with long-term heat storage.** Lenoir, Y. (Ecole Nationale Superieure de Mines de Paris, Paris, France); Sneed, C. Intertask Ltd., Ottawa, ON (Canada). 1985. (In French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The solution devised for consistent prompt optimization of the collection and distribution of resources for heating and production of domestic hot water has been the subject of original theoretical developments. The OPENSOL program is structed as a sequence of calculation diagrams to which work files and data files are assigned during the interactive exchanges with the user during the progress of an operation. OPENSOL consists essentially of three modules with the following three functions. The sizing of all dimensions affecting the thermal performance of the building and its heating installation, are optimized using the method of the steepest path, except for the power of the device consuming commercial energy, which is limited by a MINMAX algorithm. Secondly, the annual management of the solar (or climatic) energy collection and storage complex are optimized subject to limitation by a maximum available power value. The annual command function takes the form of a sequence of high-level variables (actualized marginal prices for stored

energy, threshold, and specified temperatures for distribution of collected energy between main storage and domestic hot water) and a maximum commercial power value, which serve to inform the optimum short-term and immediate commands. Lastly, it allows simulation using commands developed with more cumbersome simulation models than those that can be used for optimizations. The program can be used to calculate sub-optimum commands by switching to extreme strategies. OPENSOL is written in FORTRAN 77 and stored under UNIX. 9 refs., 8 figs.

36382 (ITL–8509, pp. 448-455) **Optimization of a combined heat pump/storage system with solar or convective heat collectors.** Franck, P.A. (Chalmers Univ. of Technology, Goeteborg, Sweden); Berntsson, T. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Results are presented of a computer simulation of whole heating system for space heating in large multifamily houses or small district heating systems. The system consists of a heat collector, which either is an ambient-air natural convective collector or a solar collector, a heat store with vertical pipes in the ground, and an electrically driven heat pump. The most important design parameters from both a technical and an economic point of view are the sizes of the collector, the storage, the heat pump, and the way the system is controlled. The influence of these parameters on the annual coefficient of performance and heat supply ratio has been obtained with computer simulations and is discussed. It is shown how this influence can be presented in a generalized way. With the aid of the technical results, an economic optimization is made both in the case of ambient air and solar collectors. The optimum is in both cases flat but sensitive to the combination of the system parts. A sensitivity analysis on the optimum is made to show the influence of investment and energy costs. Finally, the systems are compared with a heat pump without storage, which is found to be somewhat more economically advantageous at current cost levels. 3 refs., 9 figs., 1 tab.

36383 (ITL–8509, pp. 409-415) **Integrated thermal storage in energy systems for Canadian low energy houses.** Allen, G. (Allen-Drerup-White Ltd., Toronto, Canada); Kani, M. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This paper describes the design and predicted performance of a multi-functional integrated mechanical system for low energy houses that is capable of providing space heating and cooling, domestic hot water (DHW) heating, grey water heat recovery, and continuous ventilation with exhaust air heat recovery. Excess heat is used to melt a small ice storage tank, which in turn is kept cold by a heat pump transferring energy to a hot water tank (which provides DHW and hydronic space heating). Detailed hour-by-hour computer simulations using the ENERPASS program were performed and results are presented as annual heating load and energy consumptions, and summer and winter temperature profiles. Energy use, when compared to a house built to National Building Code Standards with electrical resistance heating, was over 10 times lower. 3 refs., 4 figs., 1 tab.

36384 (LBL–25363) **Energy use in buildings: The US experience and lessons for China.** Levine, M.D.; Adamson, B. Lawrence Berkeley Lab., CA (USA). Jun 1988. 10p. Sponsored by DOE Management & Administration. DOE Contract AC03-76SF00098. (CONF-8806261–1: Chinese/American symposium on energy markets and the future of energy demand, Nanjing, China, 22-24 Jun 1988). Order Number DE89014891/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper covers three topics concerning energy use in buildings. Its main focus is that of energy use in buildings in the United States. A second section describes some of the recent results of work by one the authors (BA) on energy performance of residential buildings in China. The third section contains suggestions for ways in which Chinese and US researchers could establish fruitful collaborations on energy use in buildings. 8 refs., 3 figs.

36385 (LBL–25686) **WINDOW 3.1: A PC program for analyzing window thermal performance: Program description and tutorial.** Lawrence Berkeley Lab., CA (USA). c Oct 1988. 19p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Available from Windows and Daylighting Group, Applied Science Division, Lawrence Berkely Laboratory, 1 Cyclotron Road, Berkeley, CA 94720.

WINDOW 3.1 is a public-domain computer program developed by the Windows and Daylighting Group at Lawrence Berkeley Laboratory for analyzing heat transfer through window systems. The program uses an iterative technique to calculate the one-dimensional temperature profile across a user-defined window system. From this data, window system performance indices, e.g., U-value and shading coefficients, are calculated. WINDOW 2.0, incorporates several technical additions and many new user-friendly features, while continuing to provide a consistent and versatile heat transfer analysis method. The user can vary environmental conditions, window tilt, number of glazing layers, layer properties (thermal infrared, solar and visible optical properties, and thermal conductance), gap widths, composition of gap gas or gas mixture fill, and spacer and frame materials. 7 refs., 3 figs.

36386 (LBL–26816) **Comparison of conventional mixing and displacement air conditioning and ventilating systems in US commercial buildings.** Sepppanen, O.; Fisk, W.J.; Eto, J.; Grimsrud, D.T. Lawrence Berkeley Lab., CA (USA). Feb 1989. 39p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-890609–2: ASHRAE annual meeting, Vancouver, Canada, 24-28 Jun 1989). Order Number DE89009056/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the last few years, a new displacement air distribution system with low velocity air supplied directly to the occupied zone and a displacement flow in the floor-to-ceiling direction has been introduced into office buildings in the Scandinavian countries. The purpose of this study was to evaluate displacement air distribution systems and compare their performance to the performance of traditional variable and constant air flow systems in US office buildings. The loads of a typical large US office building were calculated in four representative US climates (Minneapolis, Seattle, Atlanta, El Paso) with the DOE-2.1C buildings simulation program. The hourly loads and hourly weather data were used as inputs for new computer programs that simulated system performance. Energy consumption, air quality, thermal satisfaction, and the cost of the systems were calculated for three buildings zones (south, north, core) in each climate. The displacement systems were simulated using results from recent laboratory measurements. The results indicate that displacement systems generally yield superior air quality and thermal comfort compared to conventional systems with air recirculation. The energy consumed by displacement systems with heat recovery or VAV flow control was similar to the energy consumption of conventional air distribution systems operated with recirculation. However, the first cost of displacement systems is substantially higher than the first cost of conventional systems when the maximum cooling load exceeds 13 Btu/h-ft^2 (40 W/m^2) and cooling panels are required. The energy consumption of the traditional VAV systems was low. However, indoor air quality can deteriorate significantly if the combination of minimum supply air flow and minimum outdoor air entry into the air handler do not bring an adequate amount of outdoor air to each region of the building. 29 refs., 11 figs., 7 tabs.

36387 (ORNL/FTR–3251) **[Discussion of domestic refrigerator/freezer (R/F) design for nonazeotropic refrigerant mixtures**

(NARMs), Hannover, W. Germany, and visit to Kassel, W. Germany, May 2–5, 1989]: Foreign trip report. Sand, J.R.; Vineyard, E.A. Oak Ridge National Lab., TN (USA). 18 May 1989. 14p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE89014748/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this trip was to meet with Dr. H. Kruse at the University of Hannover and discuss a domestic refrigerator/freezer (R/F) design for nonazeotropic refrigerant mixtures (NARMs), inspect a R/F modified to work with NARMs, and acquire the rational and computer codes for modeling NARM R/F performance for this design.

36388 (ORNL/FTR–3291) **[International Energy Agency third experts meeting of Annex 20 on Airflow patterns within buildings, May 30–June 2, 1989, Aalborg, Denmark; June 1, Aalborg University, Denmark; June 5-6, Taastrup, Denmark]: Foreign trip report.** Harrje, D.T. Oak Ridge National Lab., TN (USA). 9 Jun 1989. 9p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE89014233/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The third experts meeting of Annex 20, Airflow Patterns Within Buildings, took place on May 30–June 2, 1989 in Aalborg, Denmark. The operating agent, A. Moser (SW), introduced two new countries to the Annex: France and West Germany, bringing the total Annex participation to 3 countries with 29 experts present. Subtask I, Single-Room Air and Contaminant Flow, is being led by T. Lemaire (NL) and emphasizes test room flow modeling and multicountry intercomparisons for a number of specified test situations. Improved airflow models is a prime goal. Subtask II, Multizone Air and Contaminant Flow and Required Measurement Techniques, is being led by C.A. Roulet (SW). The emphasis in that task, where the US is directly involved, includes flow through large openings, simulated use of doors and windows, contaminant movement, multiroom ventilation efficiency, multizone airflow measurement methods and enhanced leakage distribution measurement methods, and data bases and data sets. Laboratory visits emphasized test room facilities (Aalborg University) and multitracer airflow measurements (Technologist Institute). The Annex is making excellent progress toward its stated goals.

36389 (ORNL/FTR–3296) **[Working meeting of the International Energy Agency Annex 14 on Working fluids and transport phenomena in advanced absorption heat pumps, May 28-30, 1989, Stockholm, Sweden; May 31, 1989, Nykoping, Sweden; June 5, 1989, Stuttgart, West Germany; June 6, 1989, Essen, West Germany; June 7, 1989, Munich, West Germany]: Foreign trip report.** DeVault, R.C. Oak Ridge National Lab., TN (USA). 21 Jun 1989. 14p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE89014231/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The second national team meeting of the International Energy Agency Annex XIV: Working Fluids and Transport Phenomena in Advanced Absorption Heat Pumps was held in Stockholm, Sweden. Japan is the operating agent for Annex XIV, with Belgium, Denmark, Sweden, West Germany and the United States also participating. Participation by the US is beneficial by obtaining additional absorption fluids data not otherwise available and also by obtaining up-to-date knowledge of the research directions for the Japanese absorption research efforts. Noteworthy is the large effort being expended by the Japanese on this project, with 10 Japanese researchers attending the Annex XIV meeting. Also noteworthy was the inclusion of the ORNL Triple-Effect absorption cycle in the Japanese evaluation of 72 cycles conducted as part of Annex XIV, along with the statements that two separate projects to develop the triple-effect cycle are currently in the negotiation stage in Japan. The Japanese predict a 30+ % increase in cooling performance for the triple-effect cycle compared to any other cycle, including the "Ultra-Efficiency" double-effect machines recently developed in Japan. Visits to Swedish and West German research organizations and laboratories were informative. The most often asked questions at all locations were: "What is being done about CFC substitutes which do not harm the ozone layer?", and "What is being done to develop the technology to reduce CO_2 emissions?" (global warming concerns).

36390 (PB–89-150304/XAB) **Research and development on a 3-kW-class Stirling engine.** Suganami, T.; Fujiwara, M.; Sakai, M.; Koda, T.; Nomaguchi, T. Mitsubishi Electric Corp., Tokyo (Japan). 1988. 5p. Available from NTIS, PC EE05/MF A01.

Text in Japanese. Included in Mitsubishi Denki Giho, Vol. 62, No. 10, 81-84(1988).

The Corporation has developed a 3-kW-class displacer-type Stirling engine for the Moonlight Project (an energy-conservation project funded by the Japanese Ministry of International Trade and Industry). The engine, completed in the last year of the project, boasts a thermal efficiency of 37.3%, the world's highest. It has been established as a high-efficiency, low- noise engine with clean, low-pollution exhaust. The Corporation has also developed a Stirling-engine-driven heat pump that is highly efficient, demonstrating the suitability of the Stirling engine for such applications.

36391 (PB–89-167332/XAB) **Potential of electric heat pumps for heating water in South Africa.** Johannsen, A.; Kaiser, G. National Mechanical Engineering Research Inst., Pretoria (South Africa). Heat Mechanics Div. 1987. 18p. Available from NTIS, PC EE04/MF E04.

The objective of the project was to investigate the possible application of electrically operated heat pumps in various water-heating schemes and to obtain a quantitative assessment of the potential savings in energy in typical applications and for the country as a whole. The investigations included an analysis of typical heat-pump systems, long-term monitoring of the performances of two heat-pump installations, development of a performance model, simulation of performance in different regions of South Africa, as well as case studies of two industrial systems. Economic factors affecting the application of heat pumps are also discussed.

36392 (PB–89-172209/XAB) **Business guide to energy performance contracting. Final report.** Rosenberg, M. Technical Development Corp., Boston, MA (USA). May 1984. 63p. Available from NTIS, PC A04/MF A01.

The value of performance contracting is that it helps building owners to implement energy-efficiency measures by providing them with the expertise and financial backing to do so. Typically, the performance contractor agrees to be responsible for engineering design, equipment procurement, installation, financing, and maintenance. The building owner's payments are scaled to actual reductions in energy costs directly related to the project. The report discusses different types of energy-performance contracts, including lease, lease/purchase, shared savings, and energy service agreements and includes discussions of the advantages and disadvantages of each. It also includes information on how to solicit and evaluate performance-contracting proposals and how to negotiate and implement an energy-performance contract.

36393 (PNL-SA–16585) **Performance monitoring protocols.** Stoops, J.L. Pacific Northwest Lab., Richland, WA (USA). May 1989. 14p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. (CONF-8905123–3: End use load information and application conference, Syracuse, NY, USA, 16-17 May 1989). Order Number DE89014450/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Clearly, nothing can replace hard data when it comes to the demonstrating or evaluating the effectiveness of any energy-related conservation or resource management effort. However, what is not clear is how data should be collected and even which data needs to be collected. Data collection becomes an even more critical issue of individual projects separated by time and space but with some technical overlap are to be compared. Past efforts at these comparisons have revealed that such a comparison is next to impossible because of the wide variability of the instrumentation protocols and experimental procedure applied in each effort. The work flow in performance monitoring is the same as that of standard experimental procedure because of similar requirements for completeness and accuracy. First, the questions to be answered about a system or potential problem must be clearly defined and analysis methodologies to achieve the answers identified. Next, an instrumentation and data collection plan is developed and the equipment is installed. Data are then collected and analyzed to answer the questions. Finally, the answers are applied to derive informed decision making. Efforts under the auspices of ASHRE and ATM are proceeding to

develop consensus standards for the energy monitoring of both residential and commercial buildings. Both of these standards are focused on the process necessary to develop a protocol applicable to a specific project. However, they also include a set of minimum elements essential for completeness in any metering project.

36394 (PW–1988) **Thermal environment evaluation.** Tilley, B. Public Works Canada, Ottawa, ON (Canada). 1988. 98p. (In French and English). (MICROLOG–89-01930). Available from Canada. Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document describes interior thermal environment analysis and the techniques involved at three applicable stages of evaluation. They range from the study of plans and archives to physical measurement with sophisticated instrumentation. Environmental factors that influence the thermal state of the building occupant are measured. The occupant's perception of the thermal environment may also be investigated. One of the most important building functions is to isolate the occupants from adverse exterior thermal conditions and provide a productive and healthy interior environment. The thermal environment is determined by clothing level, activity level, air velocity, ambient air temperature, mean radiant temperature and moisture level. Since an optimal thermal environment may not be optimal in terms of the building's energy efficiency, the evaluation process will have to draw upon expertise in energy use and other disciplines at the stage where solutions are recommended. 16 refs., 4 figs., 2 tabs.

36395 (PW–D38) **Thermographic inspections of building enclosures.** Colantonio, A. Public Works Canada, Ottawa, ON (Canada). 1988. 125p. (In English and French). (MICROLOG–89-02020). Available from Canada. Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document describes the use of thermographic technology to examine the heat loss of a building enclosure, to identify damaged areas, and determine the causes and extent of enclosure deterioration. Three stages of investigation were developed: the thermographic level locates thermal anomalies; the thermologic level identifies problems and recommends remedial action; and the building science level determines the causes and effect of building problems and provides recommendations for correction. The equipment and methods used are described in detail. Background information on infrared radiation, heat transfer, and moisture migration are provided. A glossary and a bibliography are included. 17 refs., 1 tab.

36396 (PW–D39) **Thermal resistance measurement.** Colantonio, T. Public Works Canada, Ottawa, ON (Canada). 1988. 54p. (In English and French). (MICROLOG–89-01929). Available from Canada. Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document provides evaluation techniques to determine the in-situ thermal resistance of wall and roof assemblies. Such techniques are important because the desired properties of a building can differ from those specified due to inferior materials, poor workmanship or degradation over the life of the structure. Instrumentation and test methods used to determine heat flow through the enclosure assembly are described, based upon Canadian experience. These methods have three stages of evaluation: preliminary assessment, simple measurement techniques, and specialized in-depth monitoring. 11 refs., 1 tab.

36397 (SAND–89-1595C) **Evaluation of commercially available lighting design software.** McConnell, D. Sandia National Labs., Albuquerque, NM (USA). 1989. 27p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–28: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, Florida, USA, 9-12 Jul 1989). Order Number DE89014172/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

For years the lighting industry has manually entered and manually performed calculations on the photometric data that is necessary for lighting designs. In the past few years many lighting manufacturers and private lighting design software companies have published computer programs to enter and perform these calculations. Sandia National Laboratories (SNL), and other interested organizations, are involved in outdoor lighting designs for Closed Circuit Television (CCTV) that require lighting design software programs. During the period when no commercial lighting design software programs existed, SNL first used a government agency's program and then developed an in-house program. The in-house program is very powerful but has limitations, so it is not feasible to distribute it to interested organizations. This program has been used extensively for many high security outdoor lighting design projects. There is still a demand for lighting design programs, so SNL has ordered several that are commercially available. These programs are being evaluated for two reasons: (1) to determine if their features are adequate to aid the user in lighting designs, and (2) to provide that information to SNL and other organizations. The information obtained in this paper is to be used to help an end user decide if a program is needed, and if so, to choose one. This paper presents the results of evaluations performed. 5 refs., 6 figs., 3 tabs.

36398 (TCI–8705) **Rural and native housing demonstration program. Report and construction manual.** Couture, R.; Rousseau, J. Thermocube, Inc., Longueuil, PQ (Canada). 1987. 45p. (MICROLOG–88-06474). Available from Canada Mortgage and Housing Corporation, Annex Bldg., 628 Montreal Rd., Ottawa, ON, Canada K1A 0P7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A proposed design is presented for a house suitable for construction in remote areas of Canada. The house is primarily of modular construction, utilizing prefabricated insulated panels. The panels are made of waferboard with fiberglass insulation inside (R-28 for the walls, R-40 for the roof), and are factory-assembled with staples and adhesives. They are small enough to be handled by four men without needing mechanical aids such as cranes. The house can be built on several types of foundation, and is designed for easy and rapid construction by unskilled labor. Specifications are given for the manufacture of the panels, and directions are included for assembling the panels into an 80 square meter (3-bedroom) house. Cost of the panels for such a house is estimated at $8500.00. 18 figs.

36399 (TIR–440-U-498) **Large scale illumination using prism light guide and a Vortek lamp.** Whitehead, L.; Camm, D. TIR Systems Ltd., Burnaby, BC (Canada). 1987. 29p. (CE–02639). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

A greenhouse was illuminated by using a 31 m prism light guide fed from one end by a Vortek arc lamp operating at approximately half of its maximum rated output of 100 kW. Because the lighting system has only one light source, maintenance and waste heat recovery can be done at one location. Of 100 kW electrical input, 75 kW is recoverable as heat via heat exchangers. Of the remaining energy, 53 millieinsteins/s of Photosynthetically Active Radiation (PAR) enters the prism light guide, and 36 millieinsteins/s is emitted from the two emitting surfaces to illuminate the plants below. Economic analysis suggests that in large scale production, Vortek lamps coupled to prism light guides have the potential to provide a cost effective method of indoor plant illumination, as compared to conventional metal halide or high pressure sodium lighting. It is believed that this installation is a major advance in proving the technical feasibility of coupling high power sources to the prism light guide. 11 figs., 1 tab.

36400 (UNIES–8712) **Basement condensation. Field study of new homes in Winnipeg.** MacInnes, C.; Robinson, T. UNIES Ltd., Winnipeg, MB (Canada). 1987. 107p. (MICROLOG–88-06478). Available from Canada Mortgage and Housing Corporation, Annex Bldg., 628 Montreal Rd., Ottawa, ON, Canada K1A 0P7; $N/C; MF

CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A field investigation of Winnipeg houses was carried out with the three objectives of determining the causes of excessive basement condensation in new homes, recommending appropriate remedial action, and suggesting construction practices that would avoid or reduce such problems. 14 houses that either exhibited a moisture problem or illustrated some other detail relevant to the condensation question were examined. The moisture contents of air in the basements were the same as, or only slightly higher than, seasonal outdoor values for all but the wettest basements. The field observations imply that many Winnipeg houses, old and new, operate for part of the year with some interior concrete surfaces cool enough to promote condensation, yet little or no condensation occurs. However, new houses constructed during cold weather according to normal local building practices, with insulation applied on the interior over the full height of the concrete foundation wall, are susceptible to a significant condensation problem, particularly during the first summer of occupancy. The difference appears to be in the amount of drying experienced by the concrete since the time of construction. For new house basements in which problem condensation has occurred, it is recommended that the framed wall be opened up to expose the concrete, and that good drying conditions be provided in the basement for one to several months before the interior framed wall is restored. The basement condensation phenomenon could become more widespread if full-height insulation were to become more common across the country. Other mitigative or preventive construction practices suggested include insulation of foundations on the exterior, and installation of a properly sealed air/vapor barrier in the basement. 62 figs., 1 tab.

3202 Transportation

Refer also to citation(s) 35579, 36158, 37800

36401 (CONF-890790–2) **The US market for high-speed maglev vehicles.** Rote, D.M.; Coffey, H.; Johnson, L.; Daniels, E. Argonne National Lab., IL (USA). 1989. 9p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 5. world conference on transport research; Yokohama, Japan; 10-14 Jul 1989. Order Number DE89013301/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Recent studies at Argonne National Laboratory have shown that the market for high-speed magnetically levitated vehicles in the US, and in the rest of North America as well, depends strongly on how the technology is implemented. As an upgraded railway technology, it would have important benefits. However, competition with airlines would tend to make the technology uneconomical. Designed as aerospace-type vehicles with special attention to low mass and optimal aerodynamic performance and integrated into airport/airline operations, the technology would complement rather than compete with airlines. The social and economic benefits of maglev technology are discussed, and the economic viability of maglev as an airline/aerospace technology is compared to that as a railroad technology. Governing factors for potential market size and geographic distribution are addressed in detail, and the expected principal routes are described. 8 refs., 3 figs., 6 tabs.

36402 (CONF-890793–1) **Estimating departure times from traffic counts using dynamic assignment.** Janson, B.N.; Southworth, F. Oak Ridge National Lab., TN (USA). May 1989. 20p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From International conference on dynamic travel behavior analysis; Kyoto, Japan; 18-19 Jul 1989. Order Number DE89013024/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A dynamic traffic assignment algorithm and observed traffic counts are used to estimate the distribution of departure times in a trip matrix. The objective is to find the maximum entropy distribution of departure times by origin zone subject to observed traffic counts on a subset of network links. The procedure results in the estimated number of trip departures from each origin in 10-15 minute time intervals of the full analysis period. Such an analysis period will typically range from one to three hours long. We first review the dynamic assignment algorithm developed and tested in a previous paper, and then describe its use with traffic counts to estimate the departure times of a trip matrix. We present an application to a Pittsburgh network in which trip departures are estimated for each 10-minute interval of a peak-hour survey trip matrix. Computational advances such as parallel computing will enable the procedure to be run on large networks while counts are being monitored. Such an application may provide near real-time detection of temporal trip departure profiles by origin zone. 20 refs., 1 fig., 2 tabs.

36403 (DOE/IR/05106–T63) **Memphis Area Rideshare on-line information system.** Urban Consortium for Technology Initiatives (USA). Energy Task Force. Feb 1984. 93p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG02-78IR05106. Order Number DE89013828/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Since the mid 1970s, there has been an evolution in data processing needs at regional ridesharing agencies. Initially, ridesharing programs were basically "areawide carpooling efforts" which stressed pre-planned commuter surveys and large-scale computerized carpool matching using batch mode procedures. However, experience gained in efforts to influence urban travel behavior has led to the adoption of comprehensive marketing strategies and personalized transportation brokerage techniques which are more responsive to commuter needs. With this changing emphasis, new data processing tools are needed which will support new ridesharing marketing strategies, not dictate them. As described in this report, the method taken at Memphis Area Rideshare to acquire data processing capabilities needed to support new marketing approaches involved development of an in-house, on-line multi-user system using POOLMATCH ridesharing software.

36404 (PB–89-150098/XAB) **Super high-speed magnetically levitated system approaches: practical use.** Matsuda, S.; Nakao, H.; Takemasa, H. Toshibe Corp., Tokyo (Japan). Principal Office. 1988. 4p. Available from NTIS, PC EE04/MF A01.

Text in Japanese; Included in Review, Vol. 43, No. 10, 798-801(1988).

The JR-MAGLEV, utilizing superconducting magnets, has been under development since 1970 with the manufacturing of a succession of trial vehicles such as the LSM 200, ML 100, ML 500 and MLU 001. In 1979, the ML 500 trial vehicle achieved a world-record speed of 517 km/h. This was followed by the MLU 001, which recorded a speed of 350 km/h as a 3-car formation in 1986 and 400 km/h as a 2-car formation with passengers in 1987. As a result of the satisfactory results obtained by the MLU 001, a prototype vehicle for commercial service, the MLU 002, was manufactured in March 1988 and is now under testing at the Miyazaki test track, with the aim of achieving a target operational speed of 420 km/h.

36405 (PB–89-163976/XAB) **Effects of road-surface properties on the fuel consumption of trucks and buses.** du Plessis, H.W.; Yorke-Hart, M.A. Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Transport and Road Research. 1987. 29p. (CSIR-RR–487). Available from NTIS, PC EE05/MF E05.

Summary in Afrikaans. Pub. in Proceedings of the Annual Transportation Convention (ATC 1987), Vol. 4C paper 4C/XII, 26 (Aug 1987); North American Continent sales only.

A study was undertaken to investigate the effects of road-surface properties on the rolling resistance (and hence fuel consumption) of medium-sized trucks and passenger buses. The coast-down technique was used and proved to be practical and repeatable. The results indicate that road roughness and tire pressure are both significant in determining rolling resistance. Road-surface properties can be expected to affect fuel consumption by as much as 20%. Typical tire-pressure increases could cause as much as 6% less fuel to be consumed on the same surfacing.

36406 (PB–89-163984/XAB) **Effects of road condition on the operating costs of buses.** du Plessis, H.W.; Visser, A.T.; Harrison, R. Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Transport and Road Research. 1987. 39p. (CSIR-RR–488). Available from NTIS, PC EE05/MF E05.

Summary in Afrikaans. Pub. in Proceedings of the Annual Transportation Convention (ATC 1987), Vol. 2A, paper 2A/VIII 36 (Aug

1987). See also PB–89-163976. North American Continent sales only.

The effects of roadway conditions on vehicle operating costs (VOCs) have been studied extensively in a number of major research projects in developing countries. The VOC models that resulted from these studies have found applications in road-management systems and in the economic evaluation of road projects. The National Institute for Transport and Road Research (NITRR) of the CSIR recently initiated a VOC study in Southern Africa, with the aim of developing suitable relations for local use. A pilot study indicated that roads displaying a wide variety of conditions would have to be studied. A bus operator in a developing region was then approached for assistance with data collection. Road networks in the area were measured for roughness and operating cost data were collected. These items were then related to the roughness data, and operating-cost relations were thus developed. Although many issues remain unresolved, results are promising and compare favorably with those reported from other studies.

36407 (PB–89-174221/XAB) **Planning techniques for intercity transportation services. Final report.** Fraval, F.D.; Burkhardt, J.E.; Menzer, R.E. Ecosometrics, Inc., Bethesda, MD (USA). Jul 1987. 115p. Available from NTIS, PC A06/MF A01.

This report describes a process to help the public sector better understand the roles of privately provided intercity services in rural and low-density areas. It presents several methodologies that can be applied to answer basic questions state and local officials might have about the cost of, and demand for, specific services. The document first sets forth a simple process for planning intercity passenger or freight services: identification of problems and opportunities, assessing the public interest, project analysis, and analysis of costs and benefits. The document then reviews methods to estimate the costs of intercity bus services, regional airline services, and rail branch lines. It discusses approaches to estimate ridership on intercity bus and airline services, as well as some qualitative factors which influence system demand. The techniques involve simple formulas which can be computed using a pocket calculator.

36408 (PB–89-174759/XAB) **History of the negotiations of the Washington Metropolitan Area Transit Authority.** Alper, J.M. Washington Metropolitan Area Transit Authority, DC (USA). Apr 1988. 186p. (WMATA–89-2). Available from NTIS, PC A09.

This work chronicles events leading to a recommendation that an agency be created by compact among Maryland, Virginia and the District of Columbia to provide a regional rail-transportation system. The body of text describes the process through which framers of the compact finally brought the recommendation to fruition. Many issues arose during the course of negotiations, but each was resolved satisfactorily, leading to a successful political instrument that has enabled the Washington Metropolitan Area Transit Authority to design and construct a rapid-rail transit system for the metropolitan area.

36409 (SAND–88-3334C) **Energy accommodation modeling of rarefied flow over re-entry vehicle geometries using DSMC [Direct Simulation Monte Carlo].** Bartel, T.J.; Hudson, M.L. Sandia National Labs., Albuquerque, NM (USA). 1989. 14p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8906134–1: 24. thermophysics conference, Buffalo, NY, USA, 12-15 Jun 1989). Order Number DE89013525/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The influence of energy accommodation in the modeling of the gas/wall interaction is examined for rarefied flow over re-entry vehicle geometries using the Direct Simulation Monte Carlo (DSMC) algorithm. The reflected molecule's energy accommodation was varied while a uniform angular distribution was assumed. DSMC results are compared for the first time with flight data obtained from four tests using two different re-entry vehicle geometries. The altitude conditions vary from 58 to 113 km. The Knudsen number varied from less than 0.005 to greater than 10, indicating fluid conditions from the continuum to the free molecular regime. The ratio of the freestream stagnation temperature to the wall temperature was approximately 60. Surface heat fluxes and vehicle drag are compared between the flight data and the DSMC code predictions. The results indicate that a thermal accommodation coefficient less than 1.0 is appropriate for the transitional flow regime. Trends in the surface energy accommodation coefficient variation with altitude are discussed. 15 refs., 4 figs.

36410 (TVA/PUB–88/17) **Transportation rate services.** Tennessee Valley Authority, Knoxville, TN (USA). 1989. 22p. Sponsored by Tennessee Valley Authority. Order Number DE89014197/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

Transportation costs represent a major portion of a firm's overall operating expenses. TVA's transportation rate experts have the most up-to-date information on transportation rates for all modes, as well as the capability to prepare waterway feasibility studies and help clients analyze transportation costs and improve transportation planning. This paper covers these topics and gives examples.

3203 Industry and Agriculture

Refer also to citation(s) 35623, 35723, 35724, 35736, 35762, 36201, 36213, 36218, 36253, 36387, 36423, 36424, 36428, 36429, 36436, 36437, 36438, 36870, 37023

36411 (CANMET–5174) **Energy conservation in the industrial minerals sector. Comminution - Phase 3. Activity 4: monitoring and control of a dry grinding circuit using a particle size analyzer and programmable controllers.** Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). 1987. 65p. (MICROLOG–89-01171). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report constitutes Part 3 of a study of energy conservation during comminution operations in the industry. The objectives of the study were to optimize the performance of a dry grinding circuit using a high efficiency classifier in a conventional dry milling circuit, to measure particle size on-line, and to monitor the production rate, energy consumption, and particle size with a personal computer. The activities discussed in this report comprise: examination of the performance of a high efficiency classifier in a conventional milling circuit; examination of the state of development of classifiers for cement grinding circuits; examination of the use of grinding aids and anti-static agents in dry grinding circuits; monitoring and control of a dry grinding circuit using a particle size analyzer and programmable controllers; evaluation of the use of dry autogenous grinding of silica to produce coarse size sand grade product; and development of the technology necessary to optimize the comminution of mica. Important energy savings, increase in classification efficiency, and increase in production rate have been achieved. 22 figs., 4 tabs.

36412 (DOE/ID–10204-2) **Combustion research opportunities for industrial applications: Phase II.** Chace, A.S.; Hazard, H.R.; Levy, A.; Thekdi, A.C.; Ungar, E.W. USDOE Idaho Operations Office, Idaho Falls, ID (USA); Taratec Corp., Columbus, OH (USA). 31 May 1989. 131p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. Order Number DE89014157/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report completes a two-phase project to identify critical combustion technology research and development opportunities which can provide substantial energy savings and other process improvements in major industrial sectors. The major energy intensive industries considered during this project are primary Metals, Chemical, Petroleum and Coal Products, Stone, Clay and Glass, Paper, and Food. The reader will find a discussion of project concepts including an analysis of the needs and justification for each project. Projects recommended for development are documented in a manner which will facilitate rapid initiation of projects by DOE management or others responsible for improving combustion systems. Although an analysis of each project is contained in this report, a detailed development plan coordinating future development activities needs to be established in any follow-on effort. During the second phase of this project, the Phase I research opportunities were further defined and evaluated. Two project areas, namely improved heat flux and reduction in heat losses, are recommended for development which incorporate research opportunities with high potential for success. 3 refs., 5 figs.

36413 (EPRI-CU-6376) **Assessment of unitary cool storage systems: Final report.** Ayres, J.M.; Lau, H. Electric Power Research Inst., Palo Alto, CA (USA); Ayres Ezer Lau, Inc., Los Angeles, CA (USA). c Jun 1989. 286p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Cool storage systems in large commercial and industrial buildings have been proven to be an effective load management technology for electric utilities and a cost effective investment for their customers. The development of small cool storage systems designed for houses and small commercial buildings has been hindered by a lack of technical and economic data. This report records the status of this technology, evaluates manufacturers data and identifies the needs for additional research and development work. A survey of the cool storage industry was conducted and five manufacturers were identified to have products suitable for residential and small commercial applications. Their equipment and performance data were documented and evaluated. Seven utilities and other organizations that were testing and/or field monitoring unitary cool storage systems were visited, their testing programs were documented. It was found that most of the products are still in the development and demonstration stage and only one manufacturer had its product in production. Limited test performance data were available from manufacturers. Test results show that residential cool storage systems are able to effectively shift electric demand from on-peak to off-peak hours, but they are currently not cost effective. A residential/unitary cool storage R and D Workshop was conducted by EPRI at Dallas, Texas on May 3-4, 1988, the meeting minutes are included in this report. 82 figs., 24 tabs.

36414 (ETDE-mf-9788055) **Waste heat recovery from a sulfuric acid plant.** Jost, J.; Wentzel, H.U. Sachtleben Chemie G.m.b.H., Duisburg (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Energieforschung; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). [1988]. 27p. (In German). Order Number DE89788055/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

It is the aim of this project to use the waste heat from SO_3 absorption (temperature level at about 65°C) which has not been used so far, for long-distance heating by process adaptations to a temperature level of above 90°C. For this purpose a number of separate tests was carried out to re-determine the dimensions of the packed bed and the quantities of the circulating washing acid, to develop new final absorbers and to re-design the pertinent acid cylces. In this connection material problems occurred - due to the increased corrosiveness. The internal structural alteration of the plant was carried out step-by-step. The findings obtained are used for the construction of a demonstration plant.

36415 (ITL-8509, pp. 345-349) **Precooling vegetables using a block of ice produced by winter coolness.** Vigneault, C. (Engineering and Statistical Research Inst., Agriculture Canada, Ottawa, ON, Canada); Gallichand, J.; Jacob, G. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905--: ENERSTOCK '85 - 3. international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG-89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A 250-ton block of ice was made using winter coldness by superimposing successive thin layers of ice. This block of ice was stored in an insulated building and was used to precool vegetables. The results obtained were compared with those of a conventional water-based precooling system powered by a compressor. The quality of the water and the produce, the energy efficiency, and the economic aspects of both systems were compared. The results demonstrated that the system using the block of ice as a cold source had definite advangtages in all areas. However, certain parts of the system, such as the recirculation of the water flow onto the ice, must be improved. 3 refs., 4 figs., 1 tab.

36416 (ORNL/TM-11076) **Laboratory testing of a fluidized-bed dry-scrubbing process for the removal of acidic gases from a simulated incinerator flue gas: Final report.** Bradshaw, W.M.; Krishnan, R.P.; Young, J.M. Oak Ridge National Lab., TN (USA). Apr 1989. 56p. Sponsored by Department of Defense. DOE Contract AC05-84OR21400. Order Number DE89013760/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A series of bench-scale tests was conducted to evaluate a dry, fluidized-bed, scrubbing process for removing acidic gases from incinerator flue gas. The acidic gases studied were sulfur dioxide, hydrogen chloride, and phosphorus pentoxide. These gases were found to react readily with lime in a bubbling bed operating at 540°C (1000°F). Superficial gas velocity, bed temperature, bed depth, sorbent type, and sorbent utilization strongly affected the degree of acidic gas removal. Sorbent utilization was inhibited by reaction product occlusion of the particle surface. 7 refs., 7 figs., 3 tabs.

36417 (ORNL/TM-11114) **Bristol Babcock DPC 3330 controller evaluation.** Whitus, B.R. Oak Ridge National Lab., TN (USA). Apr 1989. 25p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89013759/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Tests were performed on a Bristol Babcock, Inc., Model DPC 3330 process control system to determine the suitability of both hardware and software for use as a low-cost distributed or stand-alone control system. Results of the hardware test verified that the hardware met or exceeded the company's published specifications for all test conditions except for the analog input common-mode rejection ratio (CMRR) measurement. The difference in measurement methods used during this test from the methods used by BBI was the reason for the difference in CMRR values. The unit was tested as a stand-alone controller because we did not have version 1.5 of Trolltalk-VAX software needed for the host VAX to support this unit. The software test consisted of evaluations of only those Advanced Communication and Control Language (ACCOL) modules that have been added to Bristol Babcock controllers since previous evaluations were performed by this group. Except for the logger and scheduler modules, all the ACCOL II modules evaluated worked as described in the reference manual. The logger module did not work because of an error in the early version of the firmware installed in the Beta unit tested, and this failure should not occur in production units. The scheduler module will work as described; however, some of the modes seem redundant or incorrect. The modular design of this system allows many possibilities for I/O point configuration example, a system with 20 analog inputs, 4 analog outputs, 16 discrete inputs, 16 discrete outputs, 2 counters, and 4 serial communications ports could be purchased for less than $7000 (hardware only). 4 figs., 12 tabs.

36418 (PB-89-163158/XAB) **Utilization potential of coal-combustion by-products: Somerset Power Plant case study. Final report.** Voycik, J.J.; Daley, J.R. Baker (Michael), Jr., Inc., Beaver, PA (USA). Jan 1987. 533p. Available from NTIS, PC A23/MF A01.

This report documents an 18-month study resulting in analyses of the economic potential of selling ash and ash-derived products from the Somerset Station Power Plant. Twelve different uses were examined for selling the by-products in western New York State and the Toronto Metropolitan market area. Among the applications: fly ash could be used as a partial replacement for cement in concrete mixtures, and as a mineral filler in bituminous pavements; bottom ash could be used as an anti-skid material for winter highway maintenance. The report includes an evaluation of coal-combustion by-product applications; a survey of nearly 270 potential users; chemical and physical testing of fly ash; an evaluation of technical specifications for possible market applications; and a determination of raw-material markets. All of this information became the basis for evaluating the potential markets for the by-products. Although the study was specifically aimed at marketing Somerset Station bottom and fly ashes, the methodology can be applied to other plants statewide. In addition, the report discusses a number of by-product applications not feasible for Somerset but which may be useful for other plants.

36419 (PB-89-173272/XAB) **Gas-based iron making: feasibility study. Final report, April 1985-December 1986.** Hemsath,

K.H.; Jeong, K.M.; Goldfarb, V.; Woodroffe, J.A.; Stickler, D.B. Indugas, Inc., Toledo, OH (USA). May 1987. 198p. Available from NTIS, PC A09/MF A01.

This paper explores the technical and economic feasibility of producing liquid iron and steel from finely ground iron ore through a natural gas based process. Raw materials represent 80% to 90% of the cost of present ironmaking processes. A substantial cost reduction can be achieved by changing the raw materials; metallurgical coke was replaced with natural gas, and pre-processed pellets were replaced with ground iron ore. The feasibility and performance of such natural-gas-based processes was compared to that of the blast furnace, the electric arc furnace and the direct-reduction processes. Variants of this new process were also explored. Utilization of pulverized coal and partial replacement of virgin iron units with scrap metal were considered. Related feasibility evaluations indicated that the new gas-based processes can reduce liquid metal manufacturing costs by 16% to 51%, while at the same time providing high purity iron.

36420 (UBA-FB–88-037) **Structural-engineering studies on the use of filter dusts from waste-incinerator flue gas cleaning as an aggregate bitumen in road construction.** Kluge, G. Asphalt-Labor A.J. Hinrichsen G.m.b.H. und Co., Wahlstedt (Germany, F.R.); Bundesministerium des Innern, Bonn (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.). Dec 1986. 99p. (In German). Available from Copy held by UB/TIB Hannover.

The present research work served to ascertain, by way of laboratory tests, whether it is possible to use filter dusts from waste incineration and salts from flue gas scrubbing in bituminous mixtures. In particular, the objective was to examine whether these waste-incineration products possess any properties which would adversely affect bituminous binders in the long term. For further clarification, proposals are made as to what additional tests would still have to be carried out in order to be able to use filter dust from waste incineration as fillertype material in bituminous base courses.

3206 Municipalities and Community Systems

Refer also to citation(s) 35903, 35932, 35936, 35953, 36206, 36253, 36254, 36255, 36306, 36361, 36420, 37022, 37803

36421 (BFR-R–97-1988) **Uppsala heat pump. Evaluation of a district heating heatpump abstracting heat from sewage effluents.** Enstroem, H.; Solin, L. Swedish Council for Building Research, Stockholm (Sweden). 1988. 79p. (In Swedish). Order Number DE89776232/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

This project relates to performance evaluation of a large heat pump plant in Uppsala. The work forms part of a large group of projects concerned with large heat pumps. Performance evaluation has been carried out using data collected, calibrated and stored by the Energy Technology Instrumentation Center at the Royal Institute of Technology. The report presents the results from two years performance monitoring and operational experience. The measured data has been processed and presented in such a way as to allow conclusions to be drawn concerning plant performance and to allow comparison with other similar projects to be made. (authors).

36422 (CONF-890785–1) **Long-term degradation of dilute polyacrylamide solutions in turbulent pipe flow.** Choi, U.S.; Kasza, K.E. Argonne National Lab., IL (USA). May 1989. 10p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Drag reduction international conference: additives and passive devices; Davos, Switzerland; 31 Jul - 3 aug 1989. Order Number DE89013275/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The long-term degradation behavior of 200 wppM polyacrylamide solution was studied experimentally in a closed recirculatory flow loop at temperatures of 7.2, 25 and 87.8°C. The degradation behavior was found to be strongly dependent on temperature. The results indicate that, with flow shear similar to that encountered in practical DHC pipe flow, polyacrylamide solutions are highly effective and have a reasonable lifetime at chilled water temperature of 7.2°C. 9 refs., 4 figs.

36423 (CONF-8809365–) **Sewage gas utilisation for cogeneration. Conference documentation.** Hessisches Ministerium fuer Wirtschaft und Technik, Wiesbaden (Germany, F.R.). Jan 1989. 130p. (In German). From 2. technical meeting on sewage gas utilisation for cogeneration; Muehlheim/Main, Germany, F.R.; 27 Sep 1988. Order Number DE89788277/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

The report presents experience and results of the operation of cogeneration aggregates in small and medium-sized waste water purification plants. Data were acquired on the operation of both cogeneration plants and sewage treatment plants. Among the subjects discussed are: Energy conservation, cost-profit calculation, optimisation, automation, and emission control.

36424 (DOE/CE/26561–T2) **Open cycle heat pump development: Phase II, District heating case study analysis: Progress report, October 1988–December 31, 1988.** DiBella, F.; Becker, F.E.; Glick, J. TECOGEN, Inc., Waltham, MA (USA). Apr 1989. 43p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG01-88CE26561. Order Number DE89012748/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A district heating system is proposed that uses low-level waste-energy sources, and a quasi open-cycle steam heat pump as a means of upgrading the energy in the form of hot water to use as a transport medium in the system. The use of a water-based, open-cycle heat pump appears to be extremely well suited in terms of its potential thermodynamic performance, cost, and environmental safety compared to more typical organic gased closed cycle systems. The Phase II case study provides a detailed analysis of a district heating system that utilizes the open cycle steam heat pump concept developed in Phase I. This quarterly report describes the energy audit performed on the heat source and heat sink.

36425 (DOE/IR/05106–T53) **Budgetary incentives for municipal energy management.** Urban Consortium for Technology Initiatives (USA). Energy Task Force. Jan 1985. 124p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG02-78IR05106. Order Number DE89014909/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

In most local governments, the potential dollar savings from improvements in energy efficiency do not provide a direct budgetary incentive for implementing energy management programs. This occurs because typical local governments; budgeting procedures obscure the logical connection between expenditures for energy projects and their resultant savings. This project, therefore, undertook to develop practical budgetary incentives for municipal energy management which would be directly incorporated into a municipality's departmental budgeting process. Realizing that the budgetary incentives developed would require the capability to track energy consumption and measure savings, the development of an energy management information system (EMIS) was simultaneously undertaken. By developing the budgetary incentives and EMIS in tandem, the EMIS was tailored to fit the needs of the budgetary incentives. To assure that the results of this project would be practical for Columbus and transferable to other local jurisdictions, their implementation was begun.

36426 (DOE/IR/05106–T59) **Municipal technologies: An assessment of energy technologies for the City of Chicago.** Urban Consortium for Technology Initiatives (USA). Energy Task Force. Dec 1982. 103p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG02-78IR05106. Order Number DE89013823/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

At a time when local government revenues are shrinking, municipal governments are faced with spiralling costs in the provision of essential city services and the operation of city departments and agencies. A primary reason for escalating costs is the rapidly increasing cost of energy. In 1979, the City of Chicago appropriated over $31 million for energy expenses and the 1982 appropriation was almost $73 million. The $73 million represents a 42% increase over the appropriation budget of 1981. An analysis of Chicago's 1982 energy budget identified the six largest energy consuming departments. The departments, in order of consumption, are Water, Streets and Sanitation, Police, Aviation, Public Works and Fire. The

major goal of the Municipal Technologies project was to demonstrate to city officials that energy consumption and related costs can be reduced by employing available and proven energy technologies. Emphasis was placed on providing information and technical assistance to those departments that were large consumers. A second goal was to encourage the departments to consider innovative financing approaches which can significantly aid them in purchasing expensive energy saving equipment. 7 refs., 1 tab.

36427 (DOE/IR/05106–T60) **Computer-assisted control for municipal water systems: Phase 1, Design for energy cost savings.** Lederer, C.C.; Dickerson, B.; Davanzo, A.C. Urban Consortium for Technology Initiatives (USA). Energy Task Force. Aug 1986. 106p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG02-78IR05106. Order Number DE89013824/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The objective of this project was to study the feasibility of developing a computer-aided program for assisting the Systems Control Center staff in reducing the overall energy consumption for supplying water to the Detroit distribution system. 4 figs., 23 tabs.

36428 (DOE/IR/05106–T67) **Inhibition of respiration in activated sludge by high carbon dioxide concentration: A laboratory study.** Urban Consortium for Technology Initiatives (USA). Energy Task Force. Feb 1988. 33p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG02-78IR05106. Order Number DE89013831/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This research project investigated the degree to which the activated sludge wastewater treatment process is inhibited by high carbon dioxide concentration. This report presents the specific methods utilized in the performance of this research and the results obtained. Experiments were done in a CO_2 rich environment, using a modified large volume respirometer. Due to operating difficulties encountered when the respirometer was modified for elevated CO_2 concentrations, inhibition was measured by comparing rate of substrate removal in the experimental respirometer with that of the control. After calibrating the experimental method with known substrates and inhibitors, a number of experiments with high CO_2 concentrations were conducted. 3 refs., 5 figs., 3 tabs.

36429 (DOE/IR/05106–T76) **Retention and expansion program for high-energy use and cost-intensive business.** Urban Consortium for Technology Initiatives (USA). Energy Task Force. Dec 1986. 99p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG02-78IR05106. Order Number DE89013840/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report was prepared by the New York City Energy and Telecommunications Office, Office of the Mayor. The documented research and program development activities are part of Urban Consortium Energy Task Force efforts to tie energy efficiency and community development to the process of economic growth. The objective of this study is to develop a program of cost-effective economic assistance measures for energy-sensitive firms. The program aims to improve the prospects for business and job retention and attraction. Many urban areas such as New York City have been experiencing business flight to other locations, both nationally and abroad, where the cost of operation is ostensibly lower. Such urban areas and municipalities are seriously concerned about their continued viability as competitive economic entities. They want to maintain and expand their employment generating economic base. A successful program of firm retention and expansion would increase the rate of economic growth, ultimately expanding out-put, creating jobs and providing a broader municipal revenue base. This report details the process of developing such a program for a target group of New York City firms. 4 refs.

36430 (DOE/IR/05106–T89) **Innovative financing plans for privately owned waste-to-energy facilities: Volume 2, User's guide.** Urban Consortium for Technology Initiatives (USA). Energy Task Force. Dec 1984. 80p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG02-78IR05106. Order Number DE89013854/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This second volume of San Diego County's Applied Research into "Innovative Financing Plans for Privately Owned Waste-To-Energy Facilities" is designed as a user's manual and program listing for the financial analysis model developed during the project. Readers wishing a general description of financing alternatives applicable for waste-to-energy facilities and San Diego's experience in evaluating these alternatives should obtain the first volume in this series as noted on the last page of this User's Manual.

36431 (ECN–89-045) **Leaching characteristics of incinerator residues and potential for modification of leaching.** Netherlands Energy Research Foundation, Petten (Netherlands). Apr 1989. 20p. Available from Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

Leaching behaviour of municipal incinerator residues is examined using a number of different extraction procedures. The influence of pH is examined and the resuts compared with the predictions from a geochemical speciation model. Despite the heterogeneous nature of incinerator residues, the leaching behaviour is found to be very systematic. Diffusion tube studies are applied to examine the behaviour of leaching metals in the waste matrices and in waste-soil combinations. The method proves to be a valuable tool for studying leaching behaviour at the waste-soil interface. 8 figs., 18 refs., 5 tabs.

36432 (NRRI–89-11) **User's manual: GCOST: A gas cost-of-service program: Version 1.0.** Harunuzzaman, M.; Iyyuni, G. National Regulatory Research Inst., Columbus, OH (USA). May 1989. 61p. Available from OSTI - National Regulatory Research Institute, Columbus, OH.

The process of rate design for a gas distribution utility requires the use of cost-of-service studies. A cost-of-service study finds the various costs of serving all of a utility's customers, and allocates these costs to individual customer classes. Costs include investments in plant and equipment, operating expenses, and taxes. There are two distinct approaches that underlie cost-of-service studies. One approach is based on marginal costs and the other on embedded costs. The marginal-cost allocation can be defined as the incremental cost of adding a single customer to the system. The embedded cost is the customer's share of historical costs. Of the two approaches, the latter is easier to implement and traditionally has been used for rate-making purposes. GCOST is designed to perform cost-of-service studies using the traditional embedded cost approach. It accepts accounting, financial, and operating data as user input. It then allocates the various items of utility plant and operating expenses to each customer class according to user-specified methods. For each cost item or account, the user has the option of specifying an allocation method or formula. This flexibility allows the user to experiment with different combinations of allocation methods. GCOST is interfaced with a database management program, which is used to prepare input data files prior to running GCOST. The user has the choice of either using DBMGR, developed by NRRI, or the commercial software dBASE III PLUS, as the database management program. GCOST is designed for use on an IBM Personal Computer XT, AT, or compatible system.

36433 (PB–89-163026/XAB) **Guide to land treatment of municipal waste water in Illinois.** Skelton, L.W.; Hinesly, T.D.; John, S.F. Institute of Technology Assessment, Springfield, IL (USA). Jan 1989. 89p. Available from NTIS, PC A05/MF A01.

Waste water is a recyclable commodity. Organic matter, nitrogen, phosphorus, and micronutrients in waste water are generally harmful when discharged to lakes and streams, but these constituents have a positive economic value when applied under properly controlled conditions to vegetated soils. The guide provides an overview of planning for a land-treatment system. It first discusses the potential for land treatment in Illinois, how to modify lagoons for land treatment, economic considerations, health and environmental concerns, regulatory requirements, and public education. It then provides more technical information on land-treatment processes, site and waste-load evaluation, systems for agricultural production, the potential for supplemental irrigation in Illinois, general site management, and system monitoring.

36434 (PB–89-173314/XAB) **Final Environmental Impact Statement. Qaste reduction, recycling, and disposal alternatives. Recycling potential assessment and waste stream**

forecast. Volume 2. Seattle Engineering Dept., WA (USA). Solid Waste Utility. Jul 1988. 222p. (SEATTLE/SWU–88/1). Available from NTIS, PC A10/MF A01.

This Environmental Impact Statement represents the culmination of significant efforts by the Seattle Solid Waste Utility to develop a solid-waste management system. The EIS recommended, as a preferred alternative, that Seattle recycle 60% of its waste stream and dispose of the remaining non-recycled waste in a distant landfill. Volume II, the Recycling Potential Assessment (RPA) and Waste Stream Forecast, explored the potential for recycling in the City of Seattle. The RPA evaluated a whole array of waste reduction and recycling programs which the City could implement to achieve recycling levels of 45-78%. The RPA was a landmark document, the first of its kind to combine a sophisticated waste stream forecast and an analysis of the cost-effectiveness of waste reduction and recycling programs.

36435 (PB–89-179022/XAB) **Summary report of capacity at commercial facilities. Volume 1. Summary report.** Bassi, J. Versar, Inc., Springfield, VA (USA). 31 Jan 1989. 141p. Available from NTIS, PC A07/MF A01.

See also Volume 2, PB–89-179030.

This report provides capacity data on commercial hazardous waste-management facilities in all States. These data, along with those in the SARA State Capacity Reports, are designed to be used in conjunction with the Biennial Report data on waste generation to support the development of the States' Capacity Assurance Plan.

36436 (PB–89-179048/XAB) **Summary report of capacity at limited commercial and company-captive facilities. Volume 1. Draft report.** Bassi, J. Versar, Inc., Springfield, VA (USA). Feb 1989. 176p. Available from NTIS, PC A09/MF A01.

See also Volume 2, PB–89-179055.

This report provides capacity data on limited commercial and company captive hazardous-waste-management facilities in all States. These data are designed to be used in conjunction with the Biennial Report on waste generation to support the development of the States' Capacity Assurance Plan.

36437 (PB–89-179055/XAB) **Summary report of capacity at limited commercial and company-captive facilities. Volume 2. Draft report.** Bassi, J. Versar, Inc., Springfield, VA (USA). Feb 1989. 317p. Available from NTIS, PC A14/MF A01.

See also Volume 1, PB–89-179048.

The document provides Appendices for Vol. I of the same title. Appendices include: facility profiles for limited commercial facilities; company captive facilities; list of commercial facilities not included in SARA capacity data base; biennial report process codes; system classification hierarchy with translation from Treatment, Storage, Disposal, and Recycling(TSDR) survey and biennial report codes to SARA management categories; and translation from TSDR survey to biennial report for permit status and commercial status codes.

36438 (PB–89-179543/XAB) **Trial-Burn Observation Guide. Final report.** Vega, L. Kearney (A.T.), Inc., Alexandria, VA (USA). Mar 1989. 74p. Available from NTIS, PC A04/MF A01.

The purpose of the Trial Burn Observation Guide is to assist Regional and State regulatory staff in observing trial burns at hazardous-waste incinerators. The Guide provides background information about such tests and identifies other documents and personnel that can provide additional information or assistance.

36439 (PB–89-861108/XAB) **Sewage-sludge pretreatment and disposal. December 1981-February 1988 (Citations from the NTIS data base). Report for December 1981-February 1988.** National Technical Information Service, Springfield, VA (USA). May 1989. 160p. Available from NTISPC N01/MF N01.

See also PB–89-861116.

This bibliography contains citations concerning techniques and equipment utilized in the pretreatment processes and disposal of sewage sludges. Topics include resource- and energy-recovery operations, land disposal, composting, ocean disposal, and incineration. Digestion, dewatering, and disinfection are among the pretreatment processes discussed. Environmental aspects, including the effects on soils, plants, and animals are also presented. (This updated bibliography contains 323 citations, none of which are new entries to the previous edition.)

36440 (PB–89-861116/XAB) **Sewage-sludge pretreatment and disposal. March 1988-April 1989 (Citations from the NTIS data base). Report for March 1988-April 1989.** National Technical Information Service, Springfield, VA (USA). May 1989. 53p. Available from NTISPC N01/MF N01.

Supersedes PB–88-859509. See also PB–89-861108.

This bibliography contains citations concerning techniques and equipment utilized in the pretreatment processes and disposal of sewage sludges. Topics include resource- and energy-recovery operations, land disposal, composting, ocean disposal, and incineration. Digestion, dewatering, and disinfection are among the pretreatment processes discussed. Environmental aspects, including the effects on soils, plants, and animals are also presented. (This updated bibliography contains 77 citations, all of which are new entries to the previous edition.)

36441 (PB–89-861231/XAB) **Ocean waste disposal: outfall sewers. January 1977-April 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-April 1989.** National Technical Information Service, Springfield, VA (USA). May 1989. 124p. Available from NTISPC N01/MF N01.

Supersedes PB–85-857662.

This bibliography contains citations concerning design, construction, and environmental effects of outfall sewers. Effects of domestic sewage on aquatic environmental and benthic ecosystems, and pollution control of outfall sewers are discussed. Monitoring of pollutants in sewage, sediments, and contaminants from sewers, and modeling of outfall sewers are also included. (This updated bibliography contains 213 citations, 45 of which are new entries to the previous edition.)

36442 Liquid fuels from the pyrolysis of municipal solid waste and its components. Evan, R.J. (Solar Energy Research Institute, Chemical Conversion Research Branch, 1617 Cole Blvd., Golden, CO (US)); Milne, T.A. v.v of Energy from biomass and wastes XI. Klass, D.L. Institute of Gas Technology, Chicago, IL (1988). (CONF-870364–: 11. IGT conference on energy from biomass and wastes, Orlando, Florida, USA, 16-20 Mar 1987).

The production of liquid fuels by the pyrolysis of municipal solid waste (MSW) requires an understanding of the composition of the liquid products and the factors which control the composition and yield. The analysis of pyrolysis oils by conventional techniques is difficult and time consuming because of their chemical complexity and polar and reactive nature. This makes the systematic study of process parameters difficult since changes in reaction conditions cannot be readily related to changes in product composition. Furthermore, the composition must be related to the chemical and physical properties of the oil which need to be known in the context of the potential fuel utilization or upgrading route. A method of oil characterization has been developed based on flash volatilization and direct molecular-beam, mass-spectrometric analysis utilizing multivariate statistical analysis techniques. This rapid data collection and analysis system has been used as a basis of compound class analysis, which characterizes collected pyrolysis oils by indexing the major classes of products, such as methoxyphenols, carbonyl compounds, anhydrosugars, hydrocarbons, etc. This experimental system is also used for real time sampling of pyrolysis products in the vapor phase for process parameter screening.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

Refer also to citation(s) 36370

3301 Internal Combustion Engines

Refer also to citation(s) 35581, 35666, 36450, 36451

36443 (BBC–TP-8328-E) **Software development for a microprocessor based controller for ac-dc-ac diesel-electric freight locomotive power unit control.** Bonert, R.; Nixon, M. BBC Brown

Boveri, Inc., Pointe Claire, PQ (Canada). 1987. 350p. (MICROLOG–89-00634). Available from Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, Canada K1A 0N5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The objective of the project was the development of advanced microprocessor software for locomotive control using the MICAS computer. The first step involved the development of a real time interactive simulation and test (RIST) system and support system for programming. The functions of the RIST system are to interface with the MICAS commputer and permit locomotive control inputs, simulate in real time the dynamic responses of the locomotive, and permit data collection and monitoring of the test software's performance. Locomotive simulation software package was also developed, permitting simulation of the engine governor response, the ac-dc-ac transmission and the locomotive wheel/rail interface condition variations, as well as data acquisition and display. The second step was the development and testing of MICAS control software. In this step, traction control software development explored various approaches to the detection and the correction of the wheelslip condition, and to configuring the ac-dc-ac drive control to improve adhesion performance. Monitoring and diagnostic software development explored the use of MICAS for data acquisition, storage, processing, and document provision or display. Diesel engine control software development optimized engine fuel efficiency by optimizing the engine operating point to the power demand. In addition, it explored the potential for fuel savings through the use of computerized multiple unit control. The third step in the program was the establishment of a laboratory facility to permit testing of the developed software on real locomotive hardware. The report contains extensive program listings and related documentation. 8 refs., 82 figs., 3 tabs.

36444 (PB–89-167282/XAB) **Engine operation on extended diesel fuels.** Falk, R.S.; Myburgh, I.S. Council for Scientific and Industrial Research, Pretoria (South Africa). National Mechanical Engineering Research Inst. 1987. 19p. Available from NTIS, PC EE04/MF E04.

The yield of diesel at the refinery can be increased by adding light hydrocarbons to diesel to produce 'light diesel' fuels. An ADE 236 diesel engine fueled with a light diesel was not able to complete a durability test owing to a fuel-related failure. Subsequent tests indicated that satisfactory durability could be achieved either by retarding the injection timing, or by retaining the standard injection timing and using an ignition-improved light diesel. A standard ADE 314 diesel engine fueled with light diesel satisfactorily completed a similar durability test. Operation on light diesel fuel caused a slight loss of power and certain components of the fuel-injection equipment showed increased wear.

36445 (PB–89-167308/XAB) **Effect of a light-diesel blend formulated by BP on the performance and durability of an ADE 314 diesel engine.** Falk, R.S. Council for Scientific and Industrial Research, Pretoria (South Africa). National Mechanical Engineering Research Inst. Jul 1987. 13p. Available from NTIS, PC EE04/MF E04.

The National Mechanical Engineering Research Institute (NMERI) carried out tests using blends of diesel with petrol and heavy naphtha, which indicated that the use of these fuels may be feasible. A durability test was then carried out on an ADE 236 diesel engine using a fuel blended to represent a 'worst case,' comprising 75% diesel and 25% hydro-treated straight run tops. The fuel was termed 'tops light diesel.' The test was terminated after 340 hours, which is equivalent to approximately 59,000 km, because of severe erosion of the pistons in the region of the combustion bowl. This erosion was caused by the poor combustion characteristics of the light diesel fuel. To overcome the problem of poor combustion, a number of ways of reducing the severity of combustion were investigated, including changes in engine settings or alteration of the composition of the fuel. Subsequent tests indicated that the ADE 236 diesel engine could operate satisfactorily on this fuel.

36446 (PB–89-167316/XAB) **Effect of a diesel blend containing heavy naphtha on the performance and durability of an ADE 236 diesel engine operating with standard-injection timing.** Falk, R.S. Council for Scientific and Industrial Research, Pretoria (South Africa). National Mechanical Engineering Research Inst. Jul 1987. 14p. Available from NTIS, PC EE04/MF E04.

The National Mechanical Engineering Research Institute (NMERI) carried out tests using blends of diesel with petrol and heavy naphtha, which indicated that the use of these fuels may be feasible. A durability test was then carried out on an ADE 236 diesel engine using a fuel blended to represent a 'worst case,' comprising 75% diesel and 25% hydro-treated straight run tops. The fuel was termed 'tops light diesel.' The test was terminated after 340 hours, which is equivalent to approximately 59,000 km, because of severe erosion of the pistons in the region of the combustion bowl. This erosion was caused by the poor combustion characteristics of the light diesel fuel.

36447 (PB–89-861348/XAB) **Ceramic engine parts. January 1972-April 1989 (Citations from the International Aerospace Abstracts data base). Report for January 1972-April 1989.** National Technical Information Service, Springfield, VA (USA). May 1989. 62p. Available from NTISPC N01/MF N01.

U.S. sales only.

This bibliography contains citations concerning manufacturing processes, testing, design, and stress analysis of ceramic engine components and coatings. Manufacturing processes discussed include slip casting, reaction sintering, hot isostatic pressing and plasma spraying. Engine parts to be used in automotive, military, land vehicle, and aircraft applications are included. (Contains 120 citations fully indexed and including a title list.)

3302 External Combustion Engines

Refer also to citation(s) 36390

36448 (DOE/NASA–4105-4) **NASA Lewis Stirling engine computer code evaluation.** Sullivan, T.J. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Sverdrup Technology, Inc., Cleveland, OH (USA). Jan 1989. 39p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AI01-85CE50112. (NASA-CR–182248). Order Number DE89014584/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In support of the US Department of Energy's Stirling Engine Highway Vehicle Systems program, the NASA Lewis Stirling engine performance code was evaluated by comparing code predictions without engine-specific calibration factors to GPU-3, P-40, and RE-1000 Stirling engine test data. The error in predicting power output was −11 percent for the P-40 and 12 percent for the RE-1000 at design conditions and 16 percent for the GPU-3 at near-design conditions (2000 rpm engine speed versus 3000 rpm at design). The efficiency and heat input predictions showed better agreement with engine test data than did the power predictions. Concerning all data points, the error in predicting the GPU-3 brake power was significantly larger than for the other engines and was mainly a result of inaccuracy in predicting the pressure phase angle. Analysis into this pressure phase angle prediction error suggested that improvement to the cylinder hysteresis loss model could have a significant effect on overall Stirling engine performance predictions. 13 refs., 26 figs., 3 tabs.

3307 Emission Control

36449 (UBA-FB–86-062) **Program to assure good in-use vehicle emissions performance in the Federal Republic of Germany through improved compliance with standards. Final report.** Walsh, M.P. Umweltbundesamt, Berlin (Germany, F.R.). Feb 1986. 73p. (In German). Available from Copy held by UB/TIB Hannover.

The in-use vehicle compliance program of the USA includes the following elements: 1. the certification with the requirement of 50.000 miles emission control function; 2. inspections/investigations of the manufacturers certification; 3. the import regulation; 4. the selective enforcement auditing to provide a high acceptable quality level; 5. the recall program, to deter manufacture of non conforming in-use vehicles; 6. the warranty program, intended to give warranty, when individual vehicles to not meet standards in-use; 7. the certification of 'aftermarket' parts to minimize anticompetitive effects; 8.

the inspection and maintenance program, consisting of emission tests of in-use vehicles; 9. the antitampering/misfueling program. In detail the experiences and methods of the inspection and maintenance program are exposed. The inspection and maintenance program has enabled a real air quality improvement. Following the good American experience a new compliance program is recommended to the German authorities, to assure good compliance with the weak European standards. (orig.) With 69 refs., 14 tabs., 6 figs.

3308 Alternative Fuels

Refer also to citation(s) 36253

36450 (PB–89-167290/XAB) **Performance and durability evaluation of a Moteurgaro engine fueled with ethanol.** Myburgh, I.S. Council for Scientific and Industrial Research, Pretoria (South Africa). National Mechanical Engineering Research Inst. Jul 1987. 13p. Available from NTIS, PC EE04/MF E04.

This paper presents the results of performance and durability tests of an ethanol-fueled Moteurgaro engine. Ethanol was specified as fuel as it was anticipated that the initial target for marketing the engine would be its use in agricultural tractors.

36451 (PB–89-167340/XAB) **NMERI (National Mechanical Engineering Research Institute) experience with alcohol fuels for diesel engines.** Hunt, M.S. Council for Scientific and Industrial Research, Pretoria (South Africa). National Mechanical Engineering Research Inst. 1987. 12p. Available from NTIS, PC EE04/MF E04.

This paper reviews research into the use of alcohols for extending or replacing existing diesel fuels. The experience has indicated that the replacement of diesel fuel by neat alcohol is a promising option for the long-term future development of alternative diesel engine fuels with both the modified fuel (as in Diesanol) and the modified engine likely to continue in the running. There do not appear to be any serious problems in the way of either of these options.

35 ARMS CONTROL

Refer also to citation(s) 36248, 36249

36452 (IAEA-INFCIRC–362) **Statement of the official spokesman of the Iraqi Ministry of Foreign Affairs.** International Atomic Energy Agency, Vienna (Austria). Apr 1989. 3p. Order Number DE89620443/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The INIS record includes IAEA-INFCIRC-362(Corr.1) of April 1989.

The document reproduces the Statement of the official spokesman of the Iraqi Ministry of Foreign Affairs issued on 5 April 1989 concerning the reports and statements alleging that Iraq is producing nuclear warheads.

36453 (IAEA-INFCIRC–363) **Statement of the Islamic Republic of Iran.** International Atomic Energy Agency, Vienna (Austria). Apr 1989. 3p. Order Number DE89620444/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The document reproduces the Statement of the Islamic Republic of Iran in answer to the statement of the official spokesman of the Iraqi Ministry of Foreign Affairs circulated in document INFCIRC/362.

36454 (LA–11564-MS) **Challenges to the nonproliferation regime into the 21st Century: Conference summary.** Pilat, J.F. Los Alamos National Lab., NM (USA). May 1989. 14p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8807171–Summs.: Challenges to the nonproliferation regime into the 21st century, Los Alamos, NM, USA, 20-21 Jul 1988). Order Number DE89013726/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An overview is presented of a conference held at the Los Alamos National Laboratory, July 20-21, 1988, on "Challenges to the Nonproliferation Regime into the 21st Century." The conference was sponsored by the Laboratory's Center for National Security Studies in cooperation with the Center for Science and International Affairs of Harvard University and the International Assessments Section of Lawrence Livermore National Laboratory.

36455 (LLNL–9014513) **Vulnerability inducing technologies: An initial appreciation.** Reinhardt, G.C. Lawrence Livermore National Lab., CA (USA). 9 Jun 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89014513/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The arms control community continues to act as though vulnerability were directly proportional to numbers of nuclear weapons, however rapidly they would voice their rejection of such a proposition if it were placed before them in an intellectual forum. Such neglect in matching action to knowledge is a well-known human phenomenon, but in this case it is particularly troublesome. START manages to reduce the numbers of weapons to just the right extent to encourage damage limiting. The present number of nuclear weapons on either side probably provides a robust deterrent; six thousand probably does not. To make matters worse, we live in a period of burgeoning technical expansion, so that even with the best intent on both sides, new technology threatens to cause new vulnerabilities in strategic systems. To pin a shorthand label on the problem, we will refer to vulnerability inducing technology as "VIT." In order to appreciate VIT, we will make a rough quantification of its consequences. This will at least provide some incentive for further study because the consequences are grave indeed. 2 tabs.

3501 Policy, Negotiations, and Legislation

Refer also to citation(s) 36247, 36460

36456 (LA–11553-MS) **Offensive versus defensive tradeoffs in the European theater.** Kelleher, C.M. Los Alamos National Lab., NM (USA). Apr 1989. 13p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE89013729/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

CNSS papers No. 18.

Researchers with the Nuclear History Project are concerned with the development of nuclear force structures. The author is one of the researchers and in this paper discusses offensive versus defensive tradeoffs in the European theater. The paper was presented at a seminar in Los Alamos on July 27, 1987, sponsored by the Center for National Security Studies. The political and military relationships within NATO are seen to be in transition. The author analyzes this transition by reviewing past watersheds: the 1956–1958 discussions about stationing medium-range ballistic missiles in Europe; the 1972 Anti-Ballistic Missile (ABM) Treaty; the intermediate-range nuclear forces (INF) discussions of 1979–1987; and the president's 1983 Strategic Defense Initiative (SDI) speech. The author points out that it will make sense to reconsider the role of particular defense structures in bringing about both a politically acceptable and military credible balance in Europe.

36457 (LA–11598-MS) **Postwar US conventional military policy: Lessons and implications for the seventh era and beyond.** Mallin, M.A. Los Alamos National Lab., NM (USA). Center for National Security Studies. May 1989. 22p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CNSS–20). Order Number DE89014572/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This study examines US national security policy and military strategy since World War II and focuses on the influences of national policy and strategy on service level planning and force procurement decisions. 41 refs.

3502 Proliferation

Refer also to citation(s) 36456

36458 (AD-A–204880/9/XAB) **Impact upon US security of a South African nuclear-weapons capability. Final technical report.** Adelman, K.L.; Knight, A.W. SRI International, Arlington, VA (USA). Strategic Studies Center. Apr 1981. 85p. (SSC-TN–1200-1). Available from NTIS, PC A05/MF A01.

Contents include: research problem and assumptions; South Africa's nuclear capability; utility for South African nuclear weapons;

the effect of South African proliferation on western economic interests; the effect of South African proliferation on western interests in access to strategic materials; the effect of South African proliferation on western political interests; the effect of South African proliferation on western military interests; south african proliferation and western security interests in general.

36459 (LA–11552-MS) **Possible roles of tactical nuclear weapons in maritime conflict.** Kauderer, B. Los Alamos National Lab., NM (USA). Mar 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE89013728/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

CNSS papers No. 17.

The possible roles that tactical nuclear weapons might play in future US-Soviet naval warfare are re-examined. Previous studies are reviewed as are the at-sea nuclear war-fighting capabilities of the two superpowers. Implications for US maritime strategy are also presented. 11 refs.

36460 (UCRL–100268-Rev.1) **Ethics and nuclear weapons research.** Brown, P.S. Lawrence Livermore National Lab., CA (USA). 20 Jan 1989. 13p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890178–1-Rev.1: Ethical issues of military research, Washington, D.C., USA, 26-29 Jan 1989). Order Number DE89014036/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Nuclear weapons are the ultimate weapons. Hence, many believe that in the realm of military research and development, research on nuclear weapons represents the ultimate. Those of us involved in nuclear weapon research are frequently asked why we do what we do, rather than get involved in the more "peaceful" endeavors open to scientists and engineers. There is a variety of answers to this question. 15 refs.

36 MATERIALS

Refer also to citation(s) 36239, 36244, 37417

3601 Metals and Alloys

Refer also to citation(s) 35536, 35537, 35538, 35539, 35586, 35627, 35685, 35769, 35777, 35789, 35819, 35820, 35950, 35951, 36014, 36082, 36168, 36175, 36357, 36366, 36368, 36621, 36622, 36629, 36633, 36668, 36670, 36726, 36742, 36918, 36932, 36940, 36944, 36985, 36986, 36987, 36988, 37185, 37679, 37688, 37691, 37692, 37695, 37697

36461 (AD-A–204742/1/XAB) **Evolution of the chemistry of passive films of sputter-deposited, supersaturated Al alloys. Annual report, 1 July 1987-30 November 1988.** Davis, G.D.; Moshier, W.C.; Fritz, T.L.; Cote, G.O.; Long, G.G. Martin Marietta Labs., Baltimore, MD (USA). Jan 1989. 49p. (MML-TR–89-12C). Available from NTIS, PC A03/MF A01.

Aluminum and conventional aluminum alloys are readily susceptible to localized attack in chloride-containing environments. Recently, under funding from the Office of Naval Research, we have investigated the passivity and corrosion behavior of several supersaturated aluminum alloys formed by co-sputter deposition. This report shows that several of these alloys exhibit superior resistance to localized attack in electro-chemical polarization measurements and salt-fog tests. X-ray photoelectron spectroscopy was used to examine the surface chemistry of the passive film as a function of applied potential for Al,Al-Ta, and Al-Zr alloys. The passive film that forms on each alloy becomes enriched in oxidized solute as the specimen is anodically polarized. In general, the oxidized solute protects the substrate by restricting the ingress of chloride and oxygen and thereby preventing or reducing localized attack and film growth, respectively. Of the solutes examined to date, Ta is the most effective in this regard; the passive film on A1-Ta alloys remains thin and protective at the most noble potentials. Breakdown occurs only as the potential drop across the film becomes great enough to allow the transport of chlorides.

36462 (AD-A–204932/8/XAB) **Microstructural refinement of W-Ni-Fe heavy alloys by alloying additions.** German, R.M. Rensselaer Polytechnic Inst., Troy, NY (USA). Dec 1988. 7p. Available from NTIS, PC A02/MF A01.

Pub. in Metallurgical Transactions A, Vol. 19A, 3099-3104(Dec 1988).

This communication describes the effect of alloying additions on grain refinement in tungsten heavy alloys and the resulting changes in mechanical properties. The body-centered-cubic refractory metals, like molybdenum and tantalum, have total solubility in tungsten and a high solubility in the matrix. The solubility of the additive in tungsten provides a means to increase the strength by solid-solution hardening. Alternatively, the solubility of tungsten in the matrix is the key to grain growth and possible strengthening by a reduction in the grain-growth size.

36463 (AD-A–204962/5/XAB) **Corrosion of high-density sintered tungsten alloys. Part 1. Immersion testing.** Batten, J.J.; McDonald, I.G.; Moore, B.T.; Silva, V.M. Materials Research Labs., Ascot Vale (Australia). Oct 1988. 45p. (MRL-R–1139). Available from NTIS, PC A03/MF A01.

See also Part 2, AD-A204 964. Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

Sintered tungsten alloys are candidate materials for certain Australian ammunition components, namely kinetic energy penetrators, because of their high density. It is probable that a storage life of twenty years in an uncontrolled environment will be a requirement for this ammunition. Thus there is a need to determine the long-term storage capability of these alloys, in particular their capability to remain un-corroded during this period. The corrosion behavior of four candidate alloys was therefore, evaluated through weight loss measurements after total immersion in both distilled water and 5% sodium chloride solutions. The propensity of these alloys to corrode in a crevice situation was assessed in the sodium chloride solution. Some insight into the mechanism of corrosion was afforded by an examination of the surfaces after the tests using the SEM and through an analysis of the corrosion products. Pure tungsten and all the alloys studied underwent corrosion during the tests, and in each case the rate of corrosion in sodium chloride solution was markedly less than that in distilled water. Examination of the data shows that for each of the tests, copper as an alloying element accelerates corrosion of tungsten alloys.

36464 (AD-A–204964/1/XAB) **Corrosion of high-density sintered tungsten alloys. Part 2. Accelerated corrosion testing.** Batten, J.J.; Moore, B.T. Materials Research Labs., Ascot Vale (Australia). Dec 1988. 31p. (MRL-R–1145). Available from NTIS, PC A03/MF A01.

See also Part 1, AD-A204 962. Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

As a consequence of corrosion during long-term storage in uncontrolled environments, where high humidity may be combined with cyclic temperature changes, some high-density sintered tungsten penetrators have been found to be unreliable. A storage life of twenty years without special storage conditions is a requirement for this ammunition, and therefore there is a need to determine the long-term storage capability of selected alloys. The corrosion behavior of four candidate alloys was evaluated and compared with that of pure tungsten. Rates of corrosion during the Cyclic Humidity Test and the Salt Mist Test were ascertained from weight-loss measurements. Insight into the corrosion mechanism was gained from the nature of the corrosion products and an examination of the corroded surfaces. The data showed that copper as an alloying element accelerates corrosion of tungsten alloys. Both attack on the tungsten particles and the binder phase were observed together with tungsten grain loss.

36465 (AD-A–205234/8/XAB) **Effect of noble gases on the properties of ion-beam-sputtered niobium films.** Lichtenwalner, D.J.; Anderson, A.C.; Rudman, D.A. Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab. Feb 1989. 4p. (JA–6147). Available from NTIS, PC A02/MF A01.

Pub. in Jnl. Vacuum Science and Technology, Vol. A7, No. 1, 102-104(Jan/Feb 1989).

All of the results presented here support the authors hypothesis that the reflection of the primary beam during sputtering plays a significant role in determining final film properties, especially in the case of ion-beam sputtering. The film properties are affected both by noble-gas incorporation in and noble-gas bombardment of the growing film. It is not as evident for sputtering in a planar arrangement for three main reasons: (i) the reflection coefficient is minimized by sputtering at normal incidence, (ii) the higher gas pressures used can scatter the reflected particles, and (iii) the target potential keeps any ionized reflected particles from escaping the dark space region, accelerating them back to the target.

36466 (AGA–9013003) **Crack growth behavior and modeling: Topical report.** Christman, T.K.; Brust, F.W. American Gas Association, Inc., New York, NY (USA); Battelle Columbus Div., OH (USA). c Mar 1989. 74p. Available from American Gas Association, 1515 Wilson Blvd., Arlington, VA 22209.

This report contains data on the investigation into the crack growth of stress-corrosion cracks. The specific subtasks examined were stress-corrosion-crack shapes, identification of a crack driving force parameter, and the relationship between crack shape and mechanical properties. Crack shape data (length and depth) was obtained from five operating pipelines. The individual cracks were found to have length-to-depth ratios ranging from 4 to 8. Longer aspects ratios up to 15 resulted when crack coalescence occurred. The deepest multiple cracks were generally no deeper than the deepest individual cracks indicating that crack coalescence does not greatly affect radial growth. The crack driving force parameter examined stress intensity, K, J-integral, crack tip opening angle (CTOD), plastic zone size for comparison with the SCC growth characteristics. To conduct the analysis, a three-dimensional finite-element model of the stress-strain field around a part-through surface flaw in line pipe was developed. 10 refs., 22 figs., 7 tabs.

36467 (AOSTRA–8808, pp. 17) **Aspects of alloy selection in thermal recovery of heavy crudes and tar sands.** Schillmoller, C.M. (Nickel Development Inst., Schillmoller Associates, Huston, TX, USA). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Enhanced oil recovery by thermal methods such as steam injection and in-situ combustion can be very effective in substantially improving the yield from existing fields, and in particular when dealing with heavy oils and tar sands. Corrosion in such systems by wet carbon dioxide, hydrogen sulfide and various organic acids can be very severe, especially in presence of producing brines and oxygen in elevated temperature producing zones. The paper reviews some of the experiences with steam flooding and in-situ combustion in California and Alberta. Problems with high uniform corrosion rates, pitting and crevice corrosion, and stress corrosion cracking are described and charts provided that define under which conditions stainless steels can be expected to perform well, and when higher alloyed Cr-Ni-Mo and Ni-Cr-Mo materials will be required for tubulars and surface equipment. In commercial scale projects, corrosion-resistant alloys can be readily justified on the basis of reliability, no need for corrosion inhibitors and coatings, and the flexibility they provide in meeting a wide range of corrosive conditions with the possibility of modifying the thermal recovery process if so desired. 16 refs., 15 figs.

36468 (AOSTRA–8808, pp. 63) **Corrosion problems and experience at AOSTRA in-situ thermal recovery pilots.** Gray, L.G.S. (Alberta Research Council, Edmonton, AB, Canada); McCormack,M.E. Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02593). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

The corrosion problems and experience are reviewed for in- situ heavy oil recovery pilot projects funded by the Alberta Oil Sands Technology and Research Authority. The focus is on the performance of well casing and tubing, as failure of downhole equipment can impact strongly on commercial project economics. In steam stimulation and steam drive processes, carbon steel tubing and casing have generally given good performance, based on 5 to 8 years of operating experience. When corrosion has been observed, it has consisted of general corrosion and pitting in the well annulus and pitting on the exterior of the well casing, neither of which was deemed a threat to long term pilot operation. Specialty alloys used in thermocouples and pressure measurement tubing frequently experienced chloride-induced pitting or stress corrosion cracking. In combustion pilots, severe corrosion has occurred in some injection and production wells. Corrosion in injection wells consisted of severe pitting and scaling from alternating injection of high pressure air and recycled water. Severe corrosion in the production wells occurred in the annulus from wet produced gas or inside the well tubing from produced emulsion. Partial or complete replacement of tubing strings has been required in some injection and production wells. Inhibitors, coatings, specialty alloys, and steam/water injection have been investigated as methods to control corrosion in combustion pilot wells. The corrosivity of the produced gas and emulsion in combustion projects appears to be associated in a complex manner to CO_2, O_2, pH, temperature, the nature of the oil, water cuts, and fluid flow rates. 32 refs., 7 figs., 2 tabs.

36469 (CANMET–MTL86-78) **Corrosion inhibition in sour media.** Sastri, V.S. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). 1988. 53p. (MICROLOG–89-01953). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Corrosion inhibition mechanisms, hydrophobicity and the effect of structure of inhibitors in corrosion inhibition in sour media are presented. Application of Hammett's equation, surface analysis and quantum chemical calculations in rationalizing the behaviour of inhibitors has been discussed. Methods used for quality control of oil field corrosion inhibitors have been discussed. The application of a hard and soft acid and base principle in the classification of corrosion inhibitors has been advanced. 142 refs., 1 fig., 19 tabs.

36470 (CHOA–8808, pp. 11) **The development of Mod N-80HO casing for cyclical steam stimulation.** Mills, A.W. (Algoma Steel Co., Ltd., Canada); Smyth, D.; Green, D.J. Canadian Heavy Oil Association (Canada). 1988. (CONF-8808237–: Thermal well completions seminar, Edmonton, Canada, 11 Aug 1988;CE–02660). In *Thermal well completions seminar.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

This paper discusses the development of Mod N-80HO steel casing at Algoma Steel Company for cyclical steam simulation. Design criteria for these casings include high temperature performance, connection integrity, resistance to cyclical compressive/tensile loading and resistance to corrosion under H_2S. The properties of the steel itself are discussed: chemical composition, tempered martensitic structure, mechanical properties, and corrosion resistance. Two types of oversized couplings are being produced at Algoma for this casing. 13 refs., 9 figs., 6 tabs.

36471 (CHOA–8808, pp. 36) **Production of ERW L80 for enhanced recovery wells.** Dorricott, J. (IPSCO, Inc., Canada). Canadian Heavy Oil Association (Canada). 1988. (CONF-8808237–: Thermal well completions seminar, Edmonton, Canada, 11 Aug 1988;CE–02660). In *Thermal well completions seminar.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.

In enhanced recovery oil well casings, the normal expectations of strength and thoughness of the wellcasings are coupled with the need to survive cyclic thermal stressing during steam injection and recovery, which demands from the product a high degree of uniformity and integrity. IPSCO pursued a program in order to develop a group of products with optimum microstructural uniformity, high metallurgical cleanness, and high dimensional accuracy and surface

quality. Eelectroresistance welded (ERW) products and seamless product were compared and ERW performance was evaluated in simulated service conditions. This paper deals with the manufacturing of ERW L80 for British Petroleum: its chemical composition and quality control; the effects of welding and heat: treatment, a comparison of ERW versus seamless casings; and testing for heavy oil service. 22 figs., 4 tabs.

36472 (CONF-890468–11) **Cross-sectional TEM [transmission electron microscopy] studies of Cr films deposited by ion-assisted deposition and physical vapor deposition.** Cheng, C.C.; Erck, R.A.; Fenske, G.R. Argonne National Lab., IL (USA). 1989. 19p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 16. international conference on metallurgical coatings and equipment exhibit; San Diego, California, USA; 17-21 Apr 1989. Order Number DE89014643/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A series of Cr films were deposited by physical vapor deposition and ion-assisted deposition as a function of the incident ion energy and the ion/atom arrival-rate ratio, R. Cross section transmission electron microscopy was used to study the microstructure of the substrate/film interface and film surface regions of these Cr films. High-energy ion bombardment (>300 eV) was found to enhance the adhesion of the deposited film owing to the formation of an intermixing layer at the interface region. Hardness data suggest that high ion energy and low ion/atom arrival-rate ratios produce films with relatively high hardness because few pores and many defects are present. 10 refs., 5 figs., 1 tab.

36473 (CONF-890541–1) **Structural ceramics in the advanced materials world.** Craig, D.F. Oak Ridge National Lab., TN (USA). 1989. 12p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From Evolution of advanced materials; Milan, Italy; 31 May - 2 jun 1989. Order Number DE89013046/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In the last sixty years, significant changes have occurred which have made ceramics attractive for a variety of complex and sophisticated applications. As higher values of strength and fracture toughness have been achieved, these advanced ceramics are being used or considered in high-temperature, load-bearing applications. The status of these ceramics is reviewed, with emphasis on methods to increase toughness. 8 figs., 1 tab.

36474 (CONF-890721–22) **Relaxation response of A533B steel from 25 to 600°C.** Swindeman, R.W.; Bolling, E. Oak Ridge National Lab., TN (USA). 1989. 8p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From Joint ASME/JSME pressure vessel and piping conference; Honolulu, Hawaii, USA; 23-27 Jul 1989. Order Number DE89010179/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

Relaxation tests were performed on A533B steel over the range 25 to 600°C in order to examine the general features of time-dependent deformation. It was found that the relaxation strength increased with the flow stress at low temperatures and was relatively independent of history at high temperatures. In the temperature range 400 to 600°C the inelastic strain rates calculated from the relaxation rates followed stress dependencies that were consistent with expectations based on a model proposed by Hart and coworkers for matrix deformation. 21 refs., 10 figs.

36475 (CONF-890721–24) **Estimating fracture toughness using tension or ball indentation tests and a modified critical strain model.** Haggag, F.M.; Nanstad, R.K. Oak Ridge National Lab., TN (USA). 1989. 7p. Sponsored by DOE/NE;NRC. DOE Contract AC05-84OR21400. From Joint ASME/JSME pressure vessel and piping conference; Honolulu, Hawaii, USA; 23-27 Jul 1989. Order Number DE89010324/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

A simple technique is described for estimating the fracture toughness by coupling the measured flow properties (either from a uniaxial tensile test or from a new automated ball indentation test) with a modified but empirically correlated critical fracture strain model. This technique is currently limited to ductile fracture applications. The modified model was used in combination with either tensile or ball indentation data to estimate fracture toughness of A515 grade 70 carbon steel and A533 grade B class 1 pressure vessel steel, respectively. The difference between fracture toughness predictions and measured values, using a computerized single-specimen unloading compliance technique in accordance with ASTM E-813, was less than 11%. 8 refs., 5 figs., 2 tabs.

36476 (CONF-8810377–1) **Grain boundaries in silicon from zero temperature through melting.** Phillpot, S.R.; Wolf, D. Argonne National Lab., IL (USA). Dec 1988. 16p. Sponsored by DOD;DOE/ER. DOE Contract W-31109-ENG-38. From Symposium on interface structure and reactions; San Francisco, California, USA; 23-26 Oct 1988. Order Number DE89013186/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Recent atomistic simulations of silicon grain boundaries are reviewed and compared with similar studies in metals. Three aspects are discussed in detail: (i) the zero-temperature structure-energy correlation, (ii) the elastic anomalies near a grain boundary at zero temperature, and (iii) the high-temperature stability of a twist boundary and its role in thermodynamic melting. In each case striking similarities with studies on metals are found. 39 refs., 8 figs.

36477 (CONF-8903140–1) **The topological structure of grain boundaries.** Rivier, N. Argonne National Lab., IL (USA). Jun 1989. 12p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Les Houches international workshop on number theory and physics; Les Houches, France; 7-16 Mar 1989. Order Number DE89014676/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

It is shown that grain boundaries are quasiperiodic tillings made of inflatable sequences of structural units. A general grain boundary is a quasiperiodic grid of dislocations with the same inflation multiplier (a quadratic irrational) in every direction. 12 refs., 7 figs.

36478 (CONF-8905168–1) **Ion-assisted deposition of silver films on ceramics for friction and wear control.** Erdemir, A.; Fenske, G.R.; Erck, R.A.; Cheng, C.C. Argonne National Lab., IL (USA). 1989. 36p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 44. annual STLE meeting; Atlanta, Georgia, USA; 1-4 May 1989. Order Number DE89014635/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Development and implementation of novel surface modification methods for controlling friction and wear of ceramic surfaces are of crucial importance to the success of ceramic tribosystems. Frictional heat, tribochemical interactions, and microfracture during sliding contact give rise to severe wear damage and frictional instabilities in tribosystems consisting of ceramic materials. This study introduces a new approach to surface modification involving ion-assisted deposition (IAD) of silver films on alumina and sapphire ceramics to achieve improved adhesion, friction, and wear behavior. The results of pin-on-disc experiments showed that silver films produced by IAD were very adherent and the wear rates of ceramic substrates coated with IAD silver were negligible. The friction coefficients of ceramic substrates were also substantially reduced by these silver films. Without ion assistance, silver films severely delaminated from the wear tracks of ceramic substrates and the wear rates and friction coefficients were relatively high. 23 refs., 7 figs., 1 tab.

36479 (CONF-8906135–1) **The Sigmajig: An improved hot-cracking test.** Goodwin, G.M. Oak Ridge National Lab., TN (USA). 1989. 4p. Sponsored by DOE Defense Programs. DOE Contract AC05-84OR21400. From International congress on technology and technology exchange; New York, NY, USA; 28 Jun 1989. Order Number DE89013029/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report covers the newly developed Sigmajig test system. This system when combined with a gas tungsten arc provides a method to test weldability for the evaluation of hot cracking sensitivity. Initial use has been with thin sheet (0.2-1.5mm) although there is no inherent thickness limitation. 5 refs., 5 figs., 1 tab. (JDF)

36480 (DOE/ER/45085–T1) **Application of quaternary phase diagrams to compound semiconductor processing: Progress report, April 1–December 31, 1988.** Schwartzman, A. Stanford Univ., CA (USA). 1989. 20p. Sponsored by DOE Energy Research. DOE Contract FG03-84ER45085. Order Number DE89014537/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report has summarized the work done on phase equilibria in II-VI quaternary systems over the last year. In general, the phase diagram depicts the geometric relationship among thermodynamic variables for phases in equilibrium with each other under an established set of conditions. Each type of thermodynamic system has a particular set of intensive variables which, when plotted against each other, best elucidate the equilibrium conditions. Isobaric, isothermal phase diagrams are used to predict solid state reactions in ternary and quaternary systems. This research has illustrated that a rigorous and methodical technique using the computer to construct quaternary phase diagrams can be successfully applied to a wide range of II-VI semiconductor systems, even for systems with solid solubility. 19 refs., 12 figs., 2 tabs.

36481 (DOE/ER/45147–4) **High resolution electron energy loss studies of surface vibrations: Progress report, July 1, 1988–June 20, 1989.** Kesmodel, L.L. Indiana Univ., Bloomington, IN (USA). Jun 1989. 7p. Sponsored by DOE Energy Research. DOE Contract FG02-84ER45147. Order Number DE89013964/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

New experimental investigations of surface vibrational properties of materials with high-resolution electron energy loss spectroscopy (EELS) are reported. The effort has focused on surface phonon dispersion measurements for copper (111) and ultrathin epitaxial films of nickel and cobalt grown on a copper (001) substrate. Data and analysis of several surface modes and resonances on Cu (111) is consistent with a modest (15%) softening of the intraplanar force constant between surface atoms. For epitaxial thin films of a few monolayers thickness of nickel on Cu (001), new film modes are identified experimentally and correspond to vibrational motion localized primarily in the film. Measurements for epitaxial films of cobalt on a Cu (001) substrate exhibit substantial flattening of the Rayleigh phonon dispersion, suggestive of surface stress in the films.

36482 (DOE/ER/45186–T1) **Structural and surface characterization of dispersed metal catalysts: Final report, September 1, 1986–December 31, 1988.** Reucroft, P.J.; De Angelis, R.J.; Bentley, J. Kentucky Univ., Lexington, KY (USA). Dept. of Materials Science and Engineering. 1988. 13p. Sponsored by DOE Energy Research. DOE Contract FG05-85ER45186. Order Number DE89014530/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The studies that have been conducted in the last two year period have extended the research activities that were initiated in 1984. Dispersed metal catalyst systems and supports investigated in the most recent phase of the project include: Ni/Co/SiO_2, Co/SiO_2, Ni/SiO_2 and ZrO_2. A model catalyst system comprising Pt layers/particles on porous and non-porous silica has also been investigated and a study has been initiated on Co, Ni and Co/Ni layers on SiO_2. Structural and Surface Characterization techniques that have been employed include: transmission electron microscopy (TEM), scanning electron microscopy (SEM), analytical electron microscopy (AEM), x-ray diffraction (XRD) and ion scattering spectroscopy (ISS). In addition, catalyst activity has been evaluated by measuring the kinetics of hydrocarbon formation from CO/H_2 mixtures. 15 refs.

36483 (DOE/ER/45262–T1) **Fundamental magnetic studies of iron-rare-earth-metalloid alloys: Technical performance report.** Sellmyer, D.J.; Hadjipanayis, G.C. Nebraska Univ., Lincoln, NE (USA); Kansas State Univ., Manhattan, KS (USA). 6 Dec 1988. 11p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER45262. Order Number DE89013803/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This research is focussed on the synthesis of new iron-rare-earth magnetic phases which may have significant technological properties. An important aim is to investigate new methods for producing these materials such as melt spinning and sputtering plus specific heat treatments. Studies are made of the relationship between microstructure and properties such as coercivity, spontaneous magnetization, and anisotropy (magnitude and direction) in bulk and thin film samples. Our goal is to understand these relatively complex materials on the basis of fundamental electronic structure, theory is of itinerant magnetism and localized 4f electronic states, and the microstructural effects which control the extrinsic properties. To achieve this a broad range of experiments and calculations are performed.

36484 Atomic level observation of grain boundaries in metals. Smith, D.A. (IBM Corp., Yorktown Heights, NY (USA)). pp. 8 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

High resolution microscopy has given an explicit, atomistic insight into the nature of the core structure of grain boundaries in metals. Specific issues which have been addressed and to some extent resolved are the occurrence of multiple structures, the transition from low angle to high angle character, the structural unit concept, the relation between the primary and secondary dislocations in a boundary, the spatial extent of the boundary core and the width of the cores of grain boundary dislocations. Much but not all that has been observed by high resolution microscopy was predicted by atomistic computer modelling.

36485 X-ray diffraction studies of the structure and properties of grain boundaries. Fitzsimmons, M.R. (Cornell Univ., Ithaca, NY (USA)); Sass, S.L. pp. 16 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Quantitative X-ray diffraction techniques have been used to study the atomic structure and thermal properties of large angle [001] twist boundaries in Au. The reciprocal lattice of the $\Sigma = 5$ boundary was mapped out using synchrotron radiation. The atomic structure of this boundary was obtained by finding the best fit to the intensity observations using a chi square analysis. The boundary structure was shown to consist of arrays of two kinds of distorted octahedra and special configurations of distorted tetrahedra interwoven together by the boundary symmetry. The Debye-Waller factor of the grain boundary (and the magnitude of the atomic displacements due to thermal motion) in the plane of the interface was determined from integrated intensity measurements as a function of temperature.

36486 Atomic structure of tilt boundaries in Mo bicrystals. Penisson, J.M. (Centre d'Etudes Nucleaires, Grenoble (France)). pp. 12 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Several tilt boundaries in Mo bicrystals have been observed by high resolution electron microscopy. The use of higher accelerating voltage leads to an increase of the resolving power. In these conditions the atomic structure can be precisely determined and compared to theoretical models. In a low angle boundary the core structure is in agreement with an empty core model. In a high angle boundary the structure is facetted and some structural units can be identified if the boundary is not too far from the symmetric position. A completely asymmetric boundary does not exhibit these structural units.

36487 Ab-initio calculation of the microscopic properties of a grain boundary in germanium. Payne, M.C. (Massachusetts Institute of Technology, Cambridge (USA)); Bristowe, P.D.; Joannopoulos, J.D. pp. 7 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

An application of the molecular dynamics simulated annealing method for performing total energy calculations is made to the study of the microscopic structure of a high-angle grain boundary in germanium. In particular, two low energy Σ=5 (001) twist boundary structures are identified and their detailed bonding geometry is analyzed by determining the local distribution of valence electron charge density. The structures are shown to exhibit two intrinsic defects: four-membered rings and three-fold coordinated atoms.

36488 Simulation study of interfaces in Ni, Al and Ni_3Al with and without boron. Chen, S.P. (Los Alamos National Lab., NM (USA)); Voter, A.F.; Srolovitz, D.J. pp. 8 of Interface science and

engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Atomistic simulations of free surfaces and [001] symmetric tilt grain boundaries in pure Ni and Al and the intermetallic, Ni_3Al, are presented. In the vicinity of the grain boundary, the authors show the existence of a rapidly decaying oscillatory strain which is similar to that observed at free surfaces. The total expansion or excess volume associated with the grain boundary is shown to be proportional to the grain boundary energy. The atomistic structures of the simulated grain boundaries have been analyzed in terms of the structural unit model, which is found to be of limited utility in the case of the intermetallic. Preliminary results show that boron segregates more strongly to grain boundaries than to free surfaces. Boron segregation strengthens the grain boundary but has little effect on grain boundary structure other than a small local expansion.

36489 Structure of Ni/MgO interfaces. Hoel, R.H. (Max-Planck-Institute fuer Metallforschung, Stuttgart (West Germany)); Ruehle, M. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Polycrystalline Ni has been solid state welded onto the (001) surface of MgO in vacuum, and the phase-boundary viewed face-on as well as edge-on in the transmission electron microscope. The extent of interdiffusion has been determined by energy dispersive X-ray microanalysis, and conventional TEM has been used to study the possible formation of new phases, the possible presence of misfit dislocations and the orientation relationship between the Ni and the MgO. The theoretical misfit dislocation structures were also calculated using the O-lattice theory.

36490 Grain boundary structure in HCP metals. King, A.H. (State Univ. of New York, Stony Brook (USA)); Chen, F.R. pp. 7 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

A transmission electron microscope study of the structures of grain boundaries in zinc has been performed. Dislocation structures are observed in many high angle boundaries, and in most cases, the boundaries that exhibit such structure are close in misorientation to a coincidence site lattice (CSL) forming misorientation. In some cases, the CSL can be formed exactly, by a simple rotation, as in the familiar cubic crystal cases, but this can only occur for rotations about the [0001] axis. For all other cases there must also be a slight constraint of the c/a ratio to some ideal value. Grain boundary structures are found to be related to constrained CSLs just as they are for exact CSLs in the more familiar cases. A serious complication for the analysis, however, is that the distribution of CSLs in misorientation space is very inhomogeneous for the HCP materials, so there are many candidate CSL systems for the analysis of any experimentally observed boundary.

36491 Star-disclination in a ferro-elastic material B19 MgCd alloy. Kitano, Y. (Hiroshima Univ. (Japan)); Kifune, K.; Komura, Y. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Disclinations in thin crystals of MgCd alloy are demonstrated by high resolution electron microscopy. The disclinations appear along the intersection lines of twin boundaries which occur due to spontaneous lattice deformations at the phase transition temperature. A star-disclination which is not an intersection line comes out to compensate the strain field of the disclinations. A single disclination is seldom observed but dipoles, tripoles, quandrupoles and multipoles of disclinations are found in stable crystals.

36492 Grain boundary structure in Ni_3Al. MacKenzie, R.A.D. (Cornell Univ., Ithaca, NY (USA)); Vaudin, M.D.; Sass, S.L. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). DOE Contract FG02-85ER45211. (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The influence of boron segregation and non-stoichiometry on grain boundary structure in Ni_3Al was studied by transmission and scanning electron microscopy techniques. Small angle twist and tilt boundaries were produced by hot pressing misoriented single crystals of both doped and undoped material. Dislocation structures were observed in both bicrystal and polycrystal grain boundaries. In most cases the grain boundary dislocations were found to have the expected a (100) Burgers vector, however in one case dislocations with Burgers vector a/2 (110) have been observed. Using a SEM diffraction technique the frequency of occurrence of grain boundary types was examined and found to be unchanged by the addition of boron.

36493 Structure of asymmetrical tilt boundaries formed during creep of (112) oriented aluminum single crystals. Mills, M.J. (Ecole Polytechnique Federale de Lausanne (Switzerland)); Stadelmann, P. pp. 8 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The structure of (110) tilt boundaries formed during creep at 400°C of (112) oriented aluminum single crystals has been studied using high resolution and weak beam electron microscopy. The dislocation content is described as a function of the plane of the boundaries and the tilt misorientation. The arrangement of the atomic columns indicates that higher angle boundaries are composed predominantly of Lomer dislocations aligned in orderly, low energy tilt configurations. The boundary plane is faceted by the presence of 60° dislocations. In contrast, lower angle boundaries tend to be less periodic and have a higher density of 60° than Lomer dislocations. The Burgers vectors of the 60° dislocations have been determined using weak beam observations and the magnitude of the twist misorientation of the boundaries agrees well with the dislocations present. The relevance of these observations with respect to glide on non-compact planes, subgrain boundary formation during creep and dislocation core observations in aluminum is also discussed.

36494 High resolution electron microscopy studies of the atomic structure of interfaces in magnetic sandwiches. Faure, J.P. (Universite de Toulon, La Garde (France)); Cesari, C.; Renard, D.; Ferrari, C.; Nihoul, G. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The authors report some studies performed on ultra-thin cobalt layers protected from oxidation by two gold films. The interfaces Au/Co of these magnetic sandwiches are studied at an atomic scale by high resolution electron microscopy. A systematic study of the micrographs by optical diffraction on a laser bench gives interesting information on the adjustment between gold and cobalt planes. this kind of result will be linked, later on, to the magnetic properties of the bidimensional layer.

36495 Interfaces in composites reinforced with rapidly solidified metallic ribbons. Ruutopold, A. (Univ. of Waterloo, Ontario (Canada)); Varin, R.A.; Wronski, Z. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Rapidly solidified continuous metallic ribbons of $Fe_{40}Ni_{40}B_{20}$ alloy have been incorporated into the polypropylene matrix. The quality of interfacial bonding has been investigated by the pull-out tests and scanning electron microscopy of the ribbon surfaces. Rapidly solidified discontinuous ribbons of $Ni_{75}Al_{23}B_1Zr_1$ alloy have been cast in the aluminum matrix. SEM combined with KEVEX analysis has been employed to study the interfacial zone formed around the ribbons.

36496 Grain-boundary dislocations structure and movement in Σ=9 studied by HREM. Thibault-Desseaux, J. (Centre d'Etudes Nucleaires, Grenoble (France)); Elkajbaji, M. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The evolution of grain-boundary structure after deformation has been studied by HREM. The decomposition of the running-in dislocations into DSC perfect dislocations has been shown. The structure of the residual dislocations was determined and their movement established at atomic scale. Glide and climb motion are involved. Conservative climb is demonstrated and the GB migration examined.

36497 TEM determination of incoherent twin-boundary structure in $L1_2$ ordered alloys. Tichelaar, F.D. (Delft Univ. of Technology (Netherlands)); Schapink, F.W. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The structure of incoherent Σ=3 twin boundaries in the $L1_2$ ordered alloy Cu_3Au is investigated employing TEM. The boundary planes are found to vary about ten degrees from a (112) plane. Employing the TEM method of α-fringes common diffraction vectors are used for determining the rigid-body translation between the two crystals at the boundary. No dilatation has been found at a (754) incoherent twin boundary within experimental error. Four grain boundary areas having different translations that preserve the density in the boundary are demonstrated, separated from each other by an antiphase boundary on one side of the boundary plane.

36498 Search for experimentally observed grain boundary phase transitions. Balluffi, R.W. (Massachusetts Institute of Technology, Cambridge (USA)); Hsieh, T.E. pp. 14 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). DOE Contract FG02-84ER45116. (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The phase space for a heterogeneous system containing a grain boundary involves a relatively large number of variables (i.e., at least six plus the number of components), and it is therefore conceptually possible to induce a large variety of grain boundary phase transitions by selectively varying these parameters. Despite this, a review of the literature reveals that there have been virtually no clear-cut experimental observations of transitions reported in which the boundary structure has been observed as a function of time under well defined conditions. In current work, the authors are searching for roughening/faceting transitions and melting transitions for boundaries in Al by hot stage transmission electron microscopy. A clear example of a reversible roughening/faceting transition has been found. No evidence for melting has been found for temperatures as high as 0.96 T_m (by monitoring GBD core delocalization in several special boundaries with Σ {<=} 13) or 0.999 T_m (by observing the local diffraction contrast at general boundaries in polycrystalline specimens).

36499 Free energy calculation via MD: methodology and application to bicrystals. Lutsko, J.F. (Argonne National Lab., IL (USA)); Wolf, D.; Yip, S. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). DOE Contract W-31-109-ENG-38. (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Three independent methods for the calculation of free energies via molecular dynamics are used to determine the free energies of crystalline solids. The relative accuracy and computational efficiency of the methods is compared and discussed. The free energies of two Cu bicrystals are then computed and compared over a wide range of temperatures and their relative stabilities are discussed.

36500 Phase equilibria and interfacial phenomena in the Mg-Al-O system at 800°C. Weirauch, D.A. Jr. (Aluminum Co. of America, Alcoa Center, PA (USA)). pp. 10 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The wetting of ceramic surfaces by aluminum alloys has been studied using Al-Mg-O as a model system. This chemical system was chosen since it is technologically important and high-purity, well-characterized materials are readily available. Magnesium alloyed with the aluminum sessile drop and silicon picked up from the experimental apparatus cause an initial reduction in contact angle by altering the protective nature of the oxide film formed on the sessile drop. Evidence of spreading is observed as an intermediate process in the reactive sessile drop pairs. Reactions between the Al-Mg alloys and sapphire (Al_2O_3), spinel ($MgAL_2O_4$), and periclase (MgO) are interpreted with predicted phase stability and the change in magnesium activity of the alloy due to volatilization. Only the rate of the periclase-alloy interaction was rapid enough to result in a continuous product layer after 24 hours. Contact angles and surface energies reflecting a true Al-Al_2O_3 interface are reported.

36501 Hydrogen segregation and diffusion at grain boundaries. Birnbaum, H.K. (Univ. of Illinois, Urbana (USA)); Ladna, B.; Kimura, A. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The segregation of hydrogen at grain boundaries in Ni has been shown to be dependent on the nature of the boundary using SIMS techniques. This contrasts to hydrogen segregation at free surfaces which appears to be less sensitive to the crystallography of the surface. The increased H concentration due to segregation occurs over appreciable distances from the surface or grain boundaries. The diffusivity of H along grain boundaries has been determined using SIMS techniques and correlated with studies of fracture kinetics.

36502 Oxygen segregation in 32°[001] molybdenum tilt grain boundary. I. Segregation sites determination. Nowicki, T.N. (Ecole Nationale Superieure des Mines, Saint-Etienne (France)); Penisson, J.M.; Biscondi, M. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The segregation sites for oxygen in molybdenum 32°[001] tilt grain boundary are determined on the basis of static grain boundary simulations and pure grain boundary high resolution electron microscope observations. Interatomic solute-solvent potentials corresponding to different solute atom radii and reproducing the enthalpy of mixing of oxygen in molybdenum (2.6 eV) are used.

36503 Oxygen segregation in 32°[001] molybdenum tilt grain boundary. II. Enthalpies of segregation determination from AES and grain boundary grooves measurements. Nowicki, T.N. (Ecole Nationale Superieure des Mines, Saint-Etienne (France)); Biscondi, M. pp. 8 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Measurements of oxygen concentration in a molybdenum 32°[001] tilt grain boundary versus quench temperature and measurements of grain boundary interfacial tension versus grain boundary concentrations are presented. A grain boundary segregation thermodynamic description involving different segregation sites is proposed. The relation between grain boundary tension and energy is discussed. Grain boundary oxygen segregation enthalpies in the different sites are found to be about −2.4 eV per atom.

36504 Experimental evidence of sulfur effect on the plane and on the extrinsic dislocations of a Σ = 3 grain boundary in nickel. Bouchet, D. (Universite Paris-Sud, Orsay (France)); Aufray, B.; Priester, L. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international

conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The evolutions of the misorientation, of the grain boundary plane and of the extrinsic dislocations (EGBD's) characteristics of the same $\Sigma = 3$ grain boundary in nickel are analyzed in function of the level of sulfur segregation in this boundary. The variation of the sulfur content is obtained by sulfidation and desulfidation of the same nickel thin foil.

36505 New ideas on interface structure from significant disagreements between experiments and prediction of interface composition in Ag base alloys. Cabane, F. (Faculte des Sciences et Techniques, Marseille (France)); Cabane, J. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Experimental results on surface and grain boundary segregation in Ag(Sn), Ag(Pb), Ag(Ni) and Ag(S) solid solutions are compared with the usual predictions of segregation. Structural aspects of interfaces are deduced by referring to the phase limiting the solubility in these binary systems.

36506 Interfacial structure modifications induced by sulfur in Ag-Ni alloys. Charai, A. (Faculte des Sciences et Techniques, Marseille (France)); Roux, D.; Rolland, A.; Saindrenan, G.; Aufray, B. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

In this paper the authors present the first results concerning the effect of an impurity of low solubility on the interfacial structure of simple model system: the Ag/Ni system with sulfur as the impurity common to the two metals. The Ag/Ni interfaces are produced by vapor deposition and epitaxial growth on single crystal substrate of NaCl cleaved. T.E.M. observations of these interfaces show that nickel is in good epitaxy on silver while misfit dislocations network is not visible. After annealing in pure hydrogen, epitaxy is reinforced: this indicates that the (100) interface is preserved. Quite the contrary, after annealing under H_2/H_2S ambient, the (100) interface disappears.

36507 Influence of the crystallography on the incorporation of lattice dislocations in grain boundaries. Khalfallah, O. (Universite Paris-Sud, Orsay (France)); Priester, L. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Most generally, crystal dislocations may enter grain boundaries with little difficulty. The dissociation reactions of the incorporated dislocations in the grain boundaries have been widely studied, in particular in FCC materials. But the parameters which control in some cases the no incorporation of lattice dislocations have received few attention. This study is an attempt to analyze the influence of crystallography on the interaction between lattice dislocations and grain boundaries in a BCC iron-chromium alloy.

36508 Unusual segregation behavior of boron and its effect on segregation of sulfur in nickel. Ladna, B. (Univ. of Illinois, Urbana (USA)); Birnbaum, H.K. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The co-segregation of B and S to the surface and grain boundaries of Ni was studied by SAES and SIMS. B showed an unusual segregation behavior which resulted in the precipitation of Ni_3B in the near surface layer and a continuous monolayer type B segregation at the grain boundary. The S segregation was not influenced by the presence of B and resulted in a uniform monolayer surface and grain boundary coverage. Analysis of hydrogen charged samples fractured in situ suggests that B segregated to the boundaries has a beneficial effect on their strength and also reduces the negative effect of S segregation.

36509 Segregation energies of phosphorus and sulfur in various relaxed structures of grain boundaries in Ni by tight-binding approximation. Larere, A. (Universite Paris XI, Orsay (France)); Guillope, M.; Masuda-Jindo, K.I. pp. 4 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Grain boundary segregation of sp-valence impurities in Ni have been investigated using a tight-binding type electronic theory of s, p and d-basis orbitals. Two center integrals both for host and impurity atoms are determined within Harrison's universal scheme. The relative electronic energy levels Es, Ep and Ed of s, p and d basis orbital are taken from atomic structure calculations by Herman and Skillman and sp-valence impurities are assumed to be electrically neutral. Segregation energies are calculated for phosphorus and sulfur at $\Sigma = 5$ (210), $\Sigma = 5$ (310), $\Sigma = 11$ (310), $\Sigma = 11$ (113) grain boundaries, the structure of which was first relaxed by a quasi-dynamical technique. Their results show a qualitative agreement with experimental data of P and S segregation.

36510 Bismuth segregation in Cu-Bi bicrystals. Menyhard, M. (Univ. of Pennsylvania, Philadelphia (USA)); Blum, B.; McMahon, C.J. Jr.; Chikwambani, S.; Weertman, J. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The grain boundaries of randomly oriented Cu- Bi bicrystals containing about 300 wt ppm Bi were studied with a high-resolution scanning Auger microprobe. The non-planar interfaces, strongly facetted in many areas due to the Bi segregation, revealed a rather uniform Bi coverage despite a great variation in grain boundary structure. Particles concluded to be Bi were found on large areas of the intergranular fracture surfaces, apparently coexisting with the segregated layer of atomic bismuth. The Bi particles could be dissolved by heating the specimens to temperatures as low as 650°C and quenching.

36511 Enhanced concentrations of Ni at grain boundary dislocations in Ni-treated W. Lai, Z.H. (Chalmers Univ. of Technology, Goeteborg (Sweden)); Norden, H. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The enhanced concentration of Ni at grain boundaries and grain boundary dislocations in Ni treated W has been investigated using atom probe field-ion microscopy.

36512 Atomic resolution observations of solute-atom segregation and two-dimensional phase transitions at internal interfaces. Herschitz, R. (Northwestern Univ., Evanston, IL (USA)); Seidman, D.N. pp. 2 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Solute-atom segregation effects to individual stacking faults (SFs) in Co-0.96 at.% Nb and Co-0.98 at.% Fe alloys have been studied employing the atom-probe field-ion microscope (APFIM) and transmission electron diffraction technique. The mean composition of individual SFs was measured for bulk specimens which had been equilibrated in the range 450-575°C. In addition, the composition of the SFs was measured - employing the APFIM technique - with a spatial resolution, within the plane of the SFs, of ≈ 0.1 nm and with a spatial resolution of <0.4 nm perpendicular to the plane of the SFs. These measurements demonstrated the following: (a) The mean composition of the SFs increased with decreasing temperature according to an Arrhenius-like expression; (b) The Nb or Fe concentrations fall off very quickly with distance - within <0.4 nm form the plane of the SF the bulk concentration is achieved; (c) The SFs equilibrated above 450°C contained solute-atom fluctuations ($\approx$ to 2.0 nm diameter) which correspond to compositions with stoichiometries of $\approx Co_2Nb$ or $\approx Co_3Fe$.

36513 Grain boundary chemistry contributions to intergranular hot cracking. Thompson, R.G. (Univ. of Alabama, Birmingham (USA)); Radhakrishnan, B.; Mayo, D.E. pp. 10 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

This report presents recent findings concerning the role of intergranular chemistry in the mechanism of intergranular hot cracking IHC during welding. The IHC of the weld heat affected zone during welding has long been suspected of some relationship to residual elements. Until now, that relationship in nickel alloys had been lost due to the roles that bulk concentration, volume fraction of second phase, and heat treatment played in establishing the intergranular chemistry of the alloy. Experiments in this study correlated the IHC susceptibility with bulk sulfur and heat treatment. It is shown that increasing sulfur from 0.0008 to 0.009 weight percent caused a modest increase in IHC. However, heat treatment had a three fold greater effect on IHC than the sulfur range tested. It is postulated that, although an increase in bulk sulfur increases the intergranular sulfur level, heat treatment has a more potent effect on IHC through combined segregation and precipitation reactions. Auger spectroscopy, metallography, and IHC data are presented in defense of these arguments.

36514 Application of the embedded atom method to the fracture of interfaces. Baskes, M.I. (Sandia National Labs., Livermore, CA (USA)); Foiles, S.M.; Daw, M.S. pp. 14 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

A modern theory of metallic bonding, the Embedded Atom Method (EAM) provides a simple but accurate method of evaluating the energy and forces in a cluster of atoms. As an example of the utility of the EAM, surface segregation in Ni-Cu alloys and reconstruction of fcc(110) surfaces will be predicted and compared to experiment. Using energetics from the EAM and a Monte Carlo procedure, the structure and cohesive energy of grain boundaries in nickel and Ni_3Al are predicted. The brittle fracture strength of these boundaries at room temperature is determined using molecular dynamics calculations.

36515 Hetero phase boundaries in the silver-nickel system. Maurer, R. (Max-Planck-Institut fuer Metallforschung, Stuttgart (West Germany)); Fischmeister, H.F. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Using Gleiter's sphere rotation technique, the orientation relations of preferred heterophase boundaries have been determined in the system silver/nickel. Comparison with other sphere rotation studies shows great similarities between all systems studied so far, which include metals on oxides and on alkali halides. In all, 33 orientation types have been found; these can be reduced to 10 elementary boundary types if facetting and twinning at the boundary are admitted. In almost all systems, cube-on-cube is the most dominant orientation. Analysis of the preferred elementary boundaries shows that they do not conform to the lock-in or to the conventional coincidence model, but that they could be understood as coincidence boundaries with a considerably extended tolerance radius. It is suggested that such extended coincidence might not be unreasonable for pairs of materials with weak interphase bonding.

36516 Effect of high pressures on the mobility of atoms in grain boundaries. Lojkowski, W. (High Pressure Research Center, Warsaw (Poland)). pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The results of recent investigations of the effect of high pressures on grain boundary diffusion and grain boundary migration in Aluminum are compared. The activation volume for general grain boundaries migration was found to be less than 0.2 Ω (Ω - atomic volume). On the other hand the activation volume for diffusion along general boundaries and subboundaries is close to 0.8 Ω. A similar value for Ω was obtained for migration of subboundaries. It follows that the formation volume for detects controlling atomic mobility across general boundaries is significantly less than of those controlling diffusion along boundaries and dislocation climb.

36517 Common factors controlling grain and phase boundary energy. Lojkowski, W. (UNIPRESS, Sokolowska (Poland)); Fecht, H.J. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The low energy interfaces identified recently for the case of silver-silver grain boundaries as well as gold-LiF and silver-nickel interfaces by the method of sintering of spheres to flat substrate, were analyzed in a unified way. The special properties of some of those interfaces can be understood by taking into account that the following factors lead to a decrease of the interfacial energy: (i) a high fraction of atoms of one crystal locked in valleys on the surface of the other crystal, (ii) the locked atoms form close packed rows thus decreasing the elastic strain energy, (iii) in sectors separated by the locked atomic rows both crystals surfaces are parallel to low energy planes, (iv) the energy necessary to unlock an atom is higher than the energy of thermal vibrations.

36518 Electronic theory for grain boundary segregation and embrittlement of intermetallic compound Ni_3Al. Masuda-Jindo, K. (Tokyo Institute of Technology, Yokohama (Japan)). pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The cleavage strength of grain boundaries in $L1_2$ type of intermetallic compounds (Ni_3Al) is investigated using the tight-binding (TB) electronic theory of s, p and d-basis orbitals. The two center hopping integrals are determined by using the Harrison's universal TB theory and atomic energy levels are taken from the atomic structure calculations by Herman and Skillman. The local charge neutrality condition is used for both host metal and solute atoms. It is shown that cleavage strength of the grain boundaries depends strongly on the segregation of impurity atoms (boron) at the grain boundaries, in agreement with experimental results: the stoichiometry effect of the $L1_2$ compound is also discussed.

36519 Energy and structure of [100] aluminum grain boundary. Otsuki, A. (Kyoto Univ. (Japan)); Isono, H.; Mizuno, M. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The energy and structure of the [100] twist and tilt grain boundaries in aluminum have been studied by fracture stress and dihedral angle measurements. The relative boundary energy was estimated as a function of misorientation. The fracture stress and the dihedral angle show a discontinuous change at a temperature, suggesting a drastic change in the grain boundary energy at this temperature. This transition temperature was measured as a function of misorientation.

36520 Role of grain boundary structure on the electrochemical stability of passive films formed on high purity polycrystalline nickel. Palumbo, G. (Univ. of Toronto, Ontario (Canada)); Aust, K.T. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Electrochemical techniques were utilized in conjunction with SEM/ECP to investigate the effects of grain boundary structure (i.e. CSL) on the intergranular corrosion behavior of high purity polycrystalline Ni (99.999%) in 2 N H_2SO_4. Characteristic electrochemical potentials (Egb) for the initiation of grain boundary corrosion were found

to exist within the passive-transpassive potential range. These potentials were determined to be strongly structure-dependent (i.e. Σ, ΔΘ) with boundaries close to low-Σ CSL relationships displaying a high resistance to the initiation of localized attack (i.e. high Egb). These results are discussed in terms of the stability of passive films formed at crystalline defects.

36521 Grain boundary internal friction and relationship to intergranular fracture. Cosandey, F. (Rutgers, The State Univ., Piscataway, NJ (USA)). pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Creep rate, stress rupture and fracture mode have been measured on Ni-20 W/O Cr alloys containing 0 and 180 at. ppm Ce. Grain boundary viscosity and anelastic relaxation phenomena have been determined by high temperature internal friction measurements and results correlated to fracture behavior.

36522 Migration of differently oriented grain boundaries measured on Fe-3wt%Si 37° (001) bicrystals. Lejcek, P. (Institute of Physics, Prague (Czechoslovakia)); Paidar, V.; Grabski, M.W. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The dependence of the grain boundary migration on the orientation of the boundary surface was investigated on Fe-3wt%Si bicrystals with 37°(001) tilt grain boundary. It was found that the migration velocity is proportional to the driving force at sufficiently high temperatures and for large values of the imposed driving force. The emigration activation energy is 3.7 eV/at for symmetrical boundary while it is only about 1eV/at for asymmetrical one.

36523 Diffusion induced grain boundary migration in Ni(Zn) polycrystals. Fournelle, R.A. (Marquette Univ., Milwaukee, WI (USA)); Giakupian, B.; Gust, W.; Predel, B. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Diffusion induced grain boundary migration (DIGM) has been investigated in the Ni(Zn) system for the first time by zincification of pure Ni polycrystals. The morphology of the reaction has been studied on sections parallel and perpendicular to the specimen surface. In addition to DIGM, diffusion induced recrystallization (DIR) has also been observed. The experimental results show that the boundary migration velocity during DIGM is strongly dependent on the annealing temperature. Also, the velocity depends on the depth below the nickel surface. The greater the depth, the smaller the velocity. Concentration profiles have been measured by energy dispersive X-ray analysis (EDX). The Zn concentration depends on both the annealing conditions and the depth below the surface. The concentration profiles were used as the basis for calculating the driving force, the grain boundary diffusivity and the grain boundary mobility.

36524 Effect of the triple junction on grain-boundary sliding in aluminum tricrystals. Miura, S. (Kyoto Univ. (Japan)); Hashimoto, S.; Fujii, T.K. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Aluminum tricrystals were crept at 773K under a constant stress in order to investigate the effect of the triple junction on high temperature deformation. It has been demonstrated that grain-boundary sliding (GBS) can be accommodated by sliding and/or migration along other boundaries, but non-uniform sliding due to the existence of the triple junction gives rise to the localized deformation zone along the boundary. In certain cases, this could be accommodated by the so-called triple-point fold without significant plastic deformation interior the grain. The origin of the fold was found to be a lattice slip, whose activated system has to contain the triple junction, but not a deformation band.

36525 Strain-induced boundary migration (SIBM) in aluminum bicrystals each with a (211) tilt boundary. Inoko, F. (Technical College of Tokushima Univ. (Japan)); Kobayashi, M. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

In order to clarify the effect of edge dislocations on the occurrence of the strain-induced boundary migration (SIBM), aluminum bicrystals each with a (211) tilt grain boundary were prepared. The bicrystals were tensile-deformed to 0.3 and annealed under certain conditions. Consequently, in the grain boundary recrystallization in the bicrystals with the primary edge dislocations in the component crystal(s) parallel to the (211) tilt boundaries of large tilt angles, the SIBM mechanism played an important role. It could be considered that the phenomena of the SIBM are strongly related to the motion and annihilation of edge dislocations or their array, and the migration of the tilt boundaries with large tilt angles.

36526 Effect of thermal aging on mechanical and electrical properties of the MgO-partially stabilized zirconia bodies. Jung, H.J. (KAIST, Seoul (Korea)); Oh, Y.J.; Lee, H.L. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The effects of thermal aging on some properties and thermal-shock behavior of zirconia partially stabilized with 9 mol% MgO (9MZ) were studied. 9MZ specimens were aged over 1300-1400°C for 12 hours subsequently after sintering at 1650°C and for 4 hours. Fracture strength (both before and after thermal-shock test), linear thermal expansion, monoclinic fraction and phase transition by XRD, density, galvanic potential and microstructure were measured. Quantitative chemical analysis around the grain-boundary of the specimen aged at 1350°C was also conducted by EDX. The aging of 9MZ specimen causes a thermal decomposition of cubic-ZrO_2 into the formation of metastable tetragonal-ZrO_2 and MgO. The former increases the residual strength after thermal-shock test and the latter improves the thermal-shock resistance due to thermal conduction through the continuous phase of magnesia. The rate of thermal decomposition of cubic phase and the formation of monoclinic phase in matrix were increased with the decrease of aging temperature from 1400 to 1200°C. Galvanic potential of the aged specimen exhibited a proper emf characteristic.

36527 Dependence of diffusion-induced grain boundary migration on grain boundary structure. King, A.H. (State Univ. of New York, Stony Brook (USA)); Chen, F.S.; Jahn, R.J. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

An extensive series of experiments on the behavior of grain boundaries during the diffusion of zinc into copper has been performed. In symmetrical tilt bicrystals, it is found that the migration velocities are minimized for coincidence-related boundaries, and that these boundaries also exhibit the greatest depth penetration of solute, the highest concentration of solute behind the moving boundary and the most pronounced faceting. Transmission electron microscope investigations indicate that there are complex defect processes occurring during DIGM: notably, it is found that significant vacancy supersaturations exist in the material behind the moving boundary and that dislocations are ejected by the boundary. These results all suggest the importance of grain boundary defects in the DIGM process itself.

36528 Mechanical behaviors of SiC whisker reinforced Al composites by powder metallurgical process. Jeong, I.B. (Seoul National Univ. (Korea)); Oh, K.H.; Lee, H.I.; Lee, D.N.; Baek, Y.K. pp. 8 of Interface science and engineering '87. Les Editions de

Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Studies were undertaken to evaluate the tensile behavior of SiC-reinforced Al composite made by powder metallurgical process, where Al 2124 and X7091 were used as matrix alloys. Although the measured tensile strength did not reach to the predicted value, it was higher than that of the wrought Al alloys and increased with increasing volumic fraction of SiC whisker. By modifying Fukuda's probabilistic theory of short fiber composite strength, it turned out that the composite strength is dependent mainly upon critical zone width, maximum whisker alignment angle and critical fiber length. Composite failure was attributed to matrix fracture with fine dimples and partially whisker pull-out due to whisker/matrix debonding.

36529 Interdiffusion of Au/Ni/Cr on silicon substrate. Yan, B. (Shanghai Jiao Tong Univ. (China)); Lin, D.; Mao, D. pp. 4 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

By using surface resistance measurement and Auger Electron Spectroscopy, the interdiffusion behavior of Au/Ni/Cr metallization on silicon substrate was examined. Cr was proved to be an excellent diffusion barrier between Au and Si up to 450°C for a Cr layer of 550 Å thick which would avoid serious degradation of solderability and resistivity of the metallization. Ni was found much less effective as a diffusion barrier and therefore was mainly to improve the solderability. It was shown that silicon outdiffusion was dominant in the interdiffusion between gold overlayer and silicon substrate. It was attributed to the large grain boundary area and high defect density in the polycrystalline gold film.

36530 TEM study of diffusion-induced grain boundary migration in Ni-Cu diffusion couples. Liu, D. (Univ. of Toronto, Ontario (Canada)); Miller, W.A.; Aust, K.T. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

A study was conducted on defect structures, orientation relationships, and compositional profiles at DIGM boundaries in Ni-Cu diffusion couples. TEM revealed dislocations at the initial grain boundary positions of the DIGM zones in the Ni substrate. The misorientation between the DIGM zones and the matrix (across the dislocation wall) was determined by electron diffraction and found to be less than 0.5°. Cu profiles across the DIGM zones were obtained by TEM/EDS analysis. The formation of the dislocation wall is discussed in terms of the misorientation and lattice misfit between the DIGM zones and the matrix.

36531 Structure of small angle tilt boundaries and their behavior under the applied shear stresses in fcc metals. Minonishi, Y. (Tohoku Univ., Sendai (Japan)); Horiuchi, R. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

A molecular statics study has been performed on (112) symmetrical tilt boundaries in fcc metals using pair potentials fitted to Cu and Ni. Boundaries are found to consist of a pair of walls of Shockley partials in both metals; distance between walls is much smaller than that between partials of an isolated extended dislocation. The separation between partial dislocation walls decreases with the increasing tilt angle and boundaries eventually come to have different structures from those observed in lower angle boundaries when the tilt angle exceeds a critical value depending on the potentials used. The critical shear strain for motion of the boundaries increases with the increasing tilt angle which is in good qualitative agreement with experimental observations so far reported.

36532 Grain boundary electrical activity of n-type germanium. Tabet, N. (CNRS, Meudon (France)); Monty, C. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The electron beam induced current mode (EBIC) of the Scanning Electron Microscope has been used to characterize the electrical activity of grain boundaries in germanium samples (n-type, doped with P or Sb). The boundaries have also been characterized from a structural point of view using Electron Channeling Patterns and X-ray topography. Low angle boundaries show an EBIC contrast which increases when the primary electron beam accelerating voltage increases. The results have been analyzed using existing models; they are not able to well describe the observed behavior as they neglect the depletion zone contribution to the contrast.

36533 Dynamic studies of deformation and fracture at grain boundaries. Robertson, I.M. (Univ. of Illinois, Urbana (USA)); Bond, G.M.; Lee, T.C.; Shih, D.S.; Birnbaum, H.K. pp. 4 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The interaction of dislocations with grain boundaries in Ni, Ni_3Al, alpha-Ti and Ni-S, are being studied by the technique of in-situ TEM deformation. Under certain conditions, grain boundaries act as effective barriers to dislocation motion, resulting in incorporation of glide dislocations into the grain boundary without slip generation in the adjacent grain. The mechanism of stress relief at the boundary depends on the boundary microchemistry and the test conditions. Stress relief may occur by the nucleation and propagation of a crack along the boundary or by the sudden, massive generation of dislocations into the adjacent grain: the dislocation sources are in and adjacent to the grain boundary.

36534 Structure and properties of nanophase TiO_2. Siegel, R.W. (Argonne National Lab., IL (USA)); Hahn, H.; Ramasamy, S.; Zongquan, L.; Ting, L.; Gronsky, R. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). DOE Contract AC03-76SF00098. (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Ultrafine-grained, nanophase samples of TiO_2 (rutile) were synthesized by the gas-condensation method and subsequent in-situ compaction, and then studied by transmission electron microscopy, Vickers hardness measurements, and positron annihilation spectroscopy as a function of sintering temperature. The nanophase compacts densified rapidly above 500°C, with only a small increase in grain size. The hardness values obtained by this method are comparable to or greater than coarser-grained compacts, but at temperatures 400 to 600°C lower than conventional sintering temperatures and without the need for sintering aids.

36535 Electron microscopy studies of diffusion-induced grain boundary migration in ceramics. Vaudin, M.D. (National Bureau of Standards, Gaithersburg, MD (USA)); Handwerker, C.A.; Blendell, J.E. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The stability of grain boundaries during the uptake of solute into polycrystalline MgO has been investigated by exposing sintered, well-annealed MgO specimens to NiO at various temperatures for different times, and observing their microstructure both before and after this exposure. Electron and optical microscopy techniques have been used to characterize the specimen surface morphology, and the variation in composition and elastic and plastic strains in the interface regions. The spatial distribution of nickel at various depths below the original specimen surface was determined using electron microprobe analysis. The observations are discussed in terms of the coherency strain theory.

36536 Effect of grain-boundary structure on stress corrosion cracking in αCu-Al alloy bicrystals. Mimaki, T. (Doshisha Univ.,

Kyoto (Japan)); Yamashita, M.; Hashimoto, S.; Miura, S. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Intergranular stress-corrosion-cracking (SCC) of Cu9at.%Al alloy was studied in (110)-symmetrical tilt bicrystals having low-angles 3.7°, 8.6°, CSL/Σ = 3(111), Σ = 9(221), Σ = 11(311) boundaries with various grain boundary energies. The Σ = 3, 9 and 11 bicrystals were fractured intergranularly. The intergranular fractures did not occur until the applied stresses higher than the yield stresses. The grain boundary energy reflected the susceptibility to intergranular SCC in a lower stress level. Especially, the Σ = 3 boundary showed a higher resistance to the initiation of intergranular SCC. The small-angle tilt bicrystals had an extremely low susceptibility to intergranular SCC even under a high level of stress ratios.

36537 Effect of manganese on intergranular fracture in low alloy steels. Tatsumi, K. (Nippon Steel Corp., Kawasaki (Japan)); Okumura, N.; Yamamoto, M. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The grain boundary embrittlement of low alloy steels was studied, attention being paid to the effect of manganese concentration. The prior austenite grain boundary of tempered martensitic samples containing 0.5, 1.0, 1.5 wt% Mn were analyzed by AES. (1) Increasing bulk manganese content was found to cause a small increase in the amount of segregated phosphorus and a decrease in the amount of segregated carbon. (2) Measurements of internal friction (Snoek peak) showed that the addition of manganese lowered the concentration of dissolved carbon. Based on these facts, the embrittling effect of manganese can be explained by the decrease of the concentration of segregated carbon which strengthens grain boundaries.

36538 Special mechanical properties of very thin films. Tsakalakos, T. (Rutgers, The State Univ., Piscataway, NJ (USA)). pp. 12 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The mechanical properties of ultrathin layered films are presented. An enhanced modulus effect has been observed in several composition modulated thin film systems containing short wavelength modulations .8-10nm. The foils were produced by vapor deposition using two or three source evaporator. As compared with homogeneous foils of the same average composition, the modulated foils exhibited an appreciable increase (up to 300%) in modulus. The dependence of various moduli on the modulation parameters (wavelength, composition and amplitude) are described. The plastic behavior, breaking and microhardness of these foils are also presented as a function of the modulation parameters. Current theories based on electronic and strain effects on the elastic constants of metals are also presented to explain the origin of the supermodulus effect.

36539 Metastable ordered compounds formed during epitaxial growth. Flynn, C.P. (Univ. of Illinois, Urbana (USA)). pp. 12 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

New ordered compounds have recently been observed to form pseudomorphically during epitaxial growth. These phases do not appear on the equilibrium bulk phase diagram. The paper first reviews the current knowledge of epitaxial strain layers. A linear stability analysis is presented of the competition among disordered phases strained by an epitaxial constrain and of the corresponding ordered epitaxial compounds. The case of volume misfit for mixed alkali halides is carried through in detail to reveal the delicate energy balance, the orientation dependences involved, and the effects of lattice anharmonicity on phase competition at the growth temperature.

36540 Critical phenomenon and segregation behavior at interfaces and subgrain boundaries. Narayan, J. (North Carolina State Univ., Raleigh (USA)); Sharan, S.; Jagannadham, K. pp. 38 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The authors have analyzed two important phenomena in lattice mismatched systems: (1) critical stresses, strains and thicknesses, and (2) dopant/impurity segregation at coherent, semicoherent, incoherent interfaces and subgrain boundaries. During formation of epitaxial films, the growth (pseudomorphic) occurs up to a certain thickness with planar spacing normal to the interface being essentially the same both in the substrate and the film. Above a critical thickness it becomes energetically favorable for the film to contain dislocations. This occurs usually by generating glide dislocations near the free surface because there is a lack of dislocation sources in mostly defect-free semiconductor materials. They present an analysis of the critical phenomena in semiconductors based upon this experimental fact. In previous work, the critical step associated with the generation of dislocations was largely neglected. They also consider finite (island) growth of thin films and its effect on critical phenomena. The experimental results clearly show the presence of glide dislocations in Ge/Si and GaAs/Si systems with extra half planes being in the silicon substrate. If the growth or processing temperature is high enough, then the diffusion and segregation phenomena at dislocation arrays and interfaces become important. The interaction of dopants and impurities with dislocation arrays and interfaces results in a drift term in the diffusion equation, which leads to enhanced segregation of dopants and impurities. Such segregation effects are analyzed for Ge/Si and GaAs/Si interfaces as well as subgrain boundaries in silicon.

36541 Measurements of the elastic constants, the specific heat and the entropy of grain boundaries by means of ultrafine grained materials. Korn, D. (Universitaet des Saarlandes (West Germany)); Morsch, A.; Birringer, R.; Arnold, W.; Gleiter, H. pp. 12 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Measurements of the elastic constants, the specific heat and the entropy of grain boundaries have been performed by utilizing ultrafine grained materials (Pd, 6nm grain size; Mg, 12 nm grain size; CaF_2, 7 nm grain size) about 30 to 50 vol% of which consist of grain boundaries. The results obtained suggest that: (1) The interatomic potentials in grain boundaries in metals differ from the lattice potentials. hence, the application of lattice potentials for computer simulation of boundary structures in-metals may be of limited physical relevance. (2) Boundary entropy effects are significant for the interfacial structure above half the absolute melting temperature. (3) Metastable boundary structures with enhanced boundary entropies exist. The entropy enhancement may be several times the entropy of an equilibrated interface in the same material.

36542 Cu-AlN interface: electronic structure and adhesion. Ohuchi, F.S. (E.I. du Pont de Nemours and Co., Inc., Wilmington, DE (USA)). pp. 8 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Adhesion of Cu to AlN has been studied by semi-quantitative adhesion measurements. The authors show for the first time that the adhesion strength of Cu to AlN is strongly dependent on the AlN surface crystallographic orientations. The origin of the adhesion was attributed to the intrinsic nature of Cu-AlN interactions, where Cu prefers to bond to Al.

36543 Star-disclination in a ferro-elastic material B19 MgCd alloy. Kitano, Y. (Hiroshima Univ. (Japan)); Kifune, K.; Komura, Y. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Disclinations in thin crystals of MgCd alloy are demonstrated by high resolution electron microscopy. The disclinations appear along the intersection lines of twin boundaries which occur due to spontaneous lattice deformations at the phase transition temperature. A star-disclination which is not an intersection line comes out to compensate the strain field of the disclinations. A single disclination is seldom observed but dipoles, tripoles, quandrupoles and multipoles of disclinations are found in stable crystals.

36544 (EPRI-NP–6392-M) **Microstructure and stress corrosion resistance of alloys X-750, 718, and A-286 in LWR environments: Final report.** Miglin, M.T. Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Co., Alliance, OH (USA). Research Center. c Jun 1989. 65p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The results of microstructural characterization and stress corrosion cracking test are presented for several heat treatment conditions of age-hardenable alloys X-750, 718, and A-286 used for in-core components in light-water reactors. Resistance to intergranular stress corrosion cracking was evaluated using slow-strain-rate tests in pressurized-water-reactor primary water, and microstructural etch and rising-load quality assurance tests. Detailed microstructural characterization of these alloys was performed, and stress corrosion cracking susceptibility is related to microstructural features. Alloy X-750 microstructures with heavy grain boundary coverage by $Cr_{23}C_6$ show better resistance to stress corrosion cracking in primary water, despite grain boundary chromium depletion. Alloys 718 and A-286 have good resistance to cracking in the slow-strain-rate and quality assurance tests, although neither is immune to cracking in reactor service. Results are compared with those of a related program, including crack initiation and crack growth tests in pressurized-water and boiling-water reactor environments. Recommendations are made for improvements in the quality assurance tests and in heat treatment for alloy 718. 29 refs., 15 figs., 9 tabs.

36545 (FhG-IWM-W–2/88) **Recent advances in modelling creep crack growth. Proceedings.** Riedel, H. Fraunhofer-Institut fuer Werkstoffmechanik, Freiburg im Breisgau (Germany, F.R.). Aug 1988. 31p. (CONF-890310–: 7. international conference on fracture (ICF-7), Houston, Texas, USA, 20-24 Mar 1989). Order Number DE89782878/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

At the time of the previous International Conference on Fracture, the C* integral had long been recognized as a promising load parameter for correlating crack growth rates in creep-ductile materials. The measured crack growth rates as a function of C* and of the temperature could be understood on the basis of micromechanical models. The distinction between C*-controlled and K_I-controlled creep crack growth had been clarified and first attempts had been made to describe creep crack growth in the transient regime between elastic behavior and steady-state creep. This paper describes the progress in describing transient crack growth including the effect of primary creep. The effect of crack-tip geometry changes by blunting and by crack growth on the crack-tip fields and on the validity of C* is analyzed by idealizing the growing-crack geometry by a sharp notch and using recent solutions for the notch-tip fields. A few new three-dimensional calculations of C* are cited and important theoretical points are emphasized regarding the three-dimensional fields at crack tips. Finally, creep crack growth is described by continuum-damage models for which similarity solutions can be obtained. Crack growth under small-scale creep conditions turns out to be difficult to understand. Slightly different models yield very different crack growth rates. (orig.) With 4 figs.

36546 (FRCEA-TH–153) **Dynamical properties in metallic reentrant in spin glasses studied by inelastic neutron scattering.** Lequien, S. Paris-11 Univ., 91 - Orsay (France). Jan 1988. 133p. (In French). Order Number DE89789233/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

We have studied the temperature dependence of the magnetic collective excitations in two ferromagnetic reentrant systems $(Fe_{1-x}Mn_x)_{75}P_{16}B_6Al_3$ and $Cr_{1-x}Fe_x$. The excitations are spin waves obeying the dispersion relation $\omega = \Delta + Dq^2$, where D is the magnetic stiffness constant of the system. Our measurements, using inelastic neutrons scattering, evidenced large anomalies on the thermal evolution of the magnetic dynamics the concentration dependence of which is also reported. The concentration dependence determined on a-FeMn allows us to understand better the behaviour reported for other systems where less precise measurements lead to erroneous conclusions. This point of view has been corroborated by a reexamination of the CrFe, first compound of this kind which had been studied by inelastic neutron studies. Our observations allow an interesting check for mechanisms homogeneous or inhomogeneous, which may be put forward in these systems. Associated to the observations by elastic neutron scattering they provide a new material for theoretical models.

36547 (INIS-SU–89, pp. 140) **Neutron diffraction study of crystal structure of K_2Sn_3, Rb_2Sn_3, and Cs_2Sn_3.** Drits, M.E. (AN SSSR, Moscow (USSR). Inst. Metallurgii); Sizov, R.A.; Fridman, A.S.; Zusman, L.L.; Zaritskij, V.N. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM ALLOYS/tetragonal lattices; TIN BASE ALLOYS/tetragonal lattices; INTERMETALLIC COMPOUNDS; LATTICE PARAMETERS; NEUTRON DIFFRACTION; POLYCRYSTALS; SPACE GROUPS

36548 (INIS-SU–89, pp. 139-140) **Neutron diffraction study of crystal structure of Ge_4Na, Ge_4K, Ge_4Rb, and Ge_4Cs.** Potemkin, V.F. (AN SSSR, Moscow (USSR). Inst. Metallurgii); Sizov, R.A.; Zusman, L.L.; Drits, M.E.; Zaritskij, V.N. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM ALLOYS/cubic lattices; GERMANIUM BASE ALLOYS/cubic lattices; INTERMETALLIC COMPOUNDS; LATTICE PARAMETERS; NEUTRON DIFFRACTION; POLYCRYSTALS; SPACE GROUPS

36549 (INIS-SU–89, pp. 133) **Comparative analysis of rubidium, cesium-potassium, sodium state diagrams using photometry.** Gukova, Yu.Ya. (Voronezhskij Tekhnologicheskij Inst., Voronezh (USSR)). AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM ALLOYS/phase diagrams; POTASSIUM ALLOYS/phase diagrams; RUBIDIUM ALLOYS/phase diagrams; SODIUM ALLOYS/phase diagrams; BINARY ALLOY SYSTEMS; PHOTOMETRY; SOLID SOLUTIONS

36550 (INIS-SU–89, pp. 133-134) **Evaluation of rubidium, cesium - tin, antimony state diagrams.** Gukova, Yu.Ya. (Voronezhskij Tekhnologicheskij Inst., Voronezh (USSR)). AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM ALLOYS/phase diagrams; RUBIDIUM ALLOYS/phase diagrams; ANTIMONY ALLOYS; BINARY ALLOY SYSTEMS; INTERMETALLIC COMPOUNDS; PHOTOMETRY; TIN ALLOYS

36551 (INIS-SU–89, pp. 134-135) **On photometric studies of rubidium cesium - transition metal systems.** Gukova, Yu.Ya.

(Voronezhskij Tekhnologicheskij Inst., Voronezh (USSR)). AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM ALLOYS/phase diagrams; RUBIDIUM ALLOYS/phase diagrams; BINARY ALLOY SYSTEMS; COPPER ALLOYS; INTERMETALLIC COMPOUNDS; PHOTOMETRY; RHENIUM ALLOYS; SOLID SOLUTIONS

36552 (INIS-SU–89. pp. 135) **Vapor pressure over corrosion resistant alkali metal alloys.** Zusman, L.L. (AN SSSR, Moscow (USSR). Inst. Metallurgii); Petrov, A.A.; Potemkin, V.F.; Fridman, A.S. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM ALLOYS/vapor pressure; LITHIUM ALLOYS/vapor pressure; ALUMINIUM BASE ALLOYS; BINARY ALLOY SYSTEMS; CORROSION RESISTANT ALLOYS; GERMANIUM BASE ALLOYS; HIGH TEMPERATURE; KNUDSEN FLOW; TEMPERATURE DEPENDENCE

36553 (INIS-SU–89, pp. 136-137) **Experimental study of phase equilibrium of liquid - vapor for cesium - sodium, potassium alloys.** Mozgovoj, A.G. (AN SSSR, Moscow (USSR). Inst. Metallurgii); Pokrasin, M.A.; Roshchupkin, V.V.; Shkermotov, V.I. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM BASE ALLOYS/phase diagrams; CHEMICAL COMPOSITION; HIGH TEMPERATURE; LIQUID METALS; POTASSIUM ALLOYS; SODIUM ALLOYS; VAPOR PRESSURE; VERY HIGH TEMPERATURE

36554 (INIS-SU–89, pp. 137-138) **Experimental study of density of liquid cesium - sodium, potassium alloys.** Mozgovoj, A.G. (AN SSSR, Moscow (USSR). Inst. Vysokikh Temperatur); Skovorod'ko, S.N.; Fomin, V.A.; Chernov, A.I. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM ALLOYS/density; BINARY ALLOY SYSTEMS; DENSITY; HIGH TEMPERATURE; LIQUID METALS; POTASSIUM ALLOYS; SODIUM ALLOYS; TERNARY ALLOY SYSTEMS

36555 (INIS-SU–89, pp. 143-144) **Surface tension of alkali metals and alloys.** Akchagirov, B.B. (Kabardino-Balkarskij Gosudarstvennyj Univ., Nal'chik (USSR)); Shebzukhov, M.D.; Arkhestov, R.Kh. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METALS/surface tension; BINARY ALLOY SYSTEMS; LIQUID METALS; WETTABILITY

36556 (INIS-SU–89, pp. 144-145) **Relationships of structural to thermodynamic properties of sodium-cesium melts.** Dergachev, M.B. (AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Organicheskogo Kataliza i Ehlektrokhimii); Panova, N.L. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM ALLOYS/thermodynamic properties; SODIUM ALLOYS/thermodynamic properties; BINARY ALLOY SYSTEMS; HIGH TEMPERATURE; LIQUID METALS; QUANTITY RATIO

36557 (INIS-SU–89, pp. 135-136) **Thermal properties of solid rubidium and cesium.** Mel'nikova, T.N. (AN SSSR, Moscow (USSR). Inst. Vysokikh Temperatur); Mozgovoj, A.G. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM/thermodynamic properties; RUBIDIUM/thermodynamic properties; CESIUM; HIGH TEMPERATURE; LEAST SQUARE FIT; RUBIDIUM; TEMPERATURE DEPENDENCE; ULTRALOW TEMPERATURE

36558 (INIS-SU–94/A, pp. 22-24) **Permittivity relaxation in $Pb_{1-x}Ge_xTe$.** Grishechkina, S.P.; Lupu, A.T. AN SSSR, Moscow (USSR). Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics.* Order Number DE89012156/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Kratkie soobshcheniya po fizike.; no. 8.

Cooperation interaction of dipoles, which reorientation energy is close to the width of the forbidden zone of the material of the composition given, and relaxation time depends greatly on the electric field is shown to make considerable contribution to dielectric permittivity both in paraelectric and ferroelectric phases $Pb_{1-x}Ge_xTe$. The results obtained do not permit to connect the observing dipole with germanium noncentral ion in the material given. 11 refs.; 2 figs.

36559 (INIS-SU–95) **Welding in nuclear technology. Scientific-technical collection.** Voprosy atomnoj nauki i tekhniki. no. 1(20). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. 66p. (In Russian). Order Number DE89012167/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Individual papers in this collection are separately indexed.

36560 (INIS-SU–95, pp. 10-14) **Methods of calculation of weldpool surface form on the reverse side of plate under welding by impulse penetrative arc.** Ishchenko, Yu.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE89012167/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(20).

Model of calculating formation of camber and surface of welded point under welding by impulse penetrative arc is presented. The specific feature of the model lies in the fact, that it takes into account two simultaneous processes: metal movement to equilibrium state and crystallizatin of liquid metal of a pool . Correlation of calculation and experimental results shows the sufficient adequacy of the model and real processes. The model can be used for analyzing the process of welding by pulse penetrative arc and for evaluating camber and shape of the surface of crystallized metal in a pool. 5 refs.; 4 figs.; 1 tab.

36561 (INIS-SU–95, pp. 17-19) **Increasing of effeciency and quality of electron beam welding of zirconium alloys by using and additional vacuum chamber.** Fokin, G.D. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE89012167/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(20).

Application of additional vacuum chamber is described. It enables to reduce not less, than five times, the period of evacuation up to high vacuum and therefore to increase welding efficiency. Application of additional vacuum chamber excludes the necessity of atmosphere overlap in welding chamber. This enables to preserve high vacuum growing with time, in welding chamber; welding quality is improved at that. 2 refs.; 1 fig.

36562 (INIS-SU–95, pp. 19-25) **Optimization of technological parameters of welding process by stabilized arc of reverse polarity.** Poloskov, S.I.; Bukarov, V.A.; Burlakov, I.A.; Dorina, T.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE89012167/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(20).

Consideration is being given to results of analyzing relative heat losses in nonconsumable electrode-anode and for scattering in surrounding space, as well as effective efficiency of welding process of aluminium alloys by stabilized arc of reverse polarity. High-speed gas flow G_{AR}, providing convective arc heat-exchange with surrounding space represents the most significant parameter from the viewpoint of energy radistribution in the system electrode-arc-sample. 9 refs.; 5 figs.; 4 tabs.

36563 (INIS-SU–95, pp. 31-32) **Installation for semiautomatic air-plasma metal cutting up to 6 mm thickness.** Bejder, B.D.; Tkachev, M.V.; Rozhnov, V.S.; Budakov, A.A.; Shevchuk, I.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE89012167/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(20).

SA401M2 installation for semiautomatic air-plasma cutting is described. Results of metallographic investigations and gas analysis of cutting edges of low-carbon steel are presented. It is shown that SA401M2 installation provides separation of metal up to 6 mm thickness at 45-85A current when nozzle is resting on a sample. 2 refs.; 3 figs.

36564 (INIS-SU–95, pp. 37-40) **On the question of nonconsumable electrode measuring of temperature in the process of argon-arc welding.** Anisimov, V.V.; Bukarov, V.A.; Nesterov, A.F.; Ryabichenko, B.R.; Alenichkin, A.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE89012167/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(20).

Consideration is given to results of investigations into the dependences of radiation intensity of nonconsumable electrodes of various types on their temperature during welding. The error, introduced by arc radiation into the measured temperature value when measuring in infrared spectrum region, was determined. 3 refs.; 5 figs.

36565 (INIS-SU–95, pp. 43-45) **Effect of construction of current and gas supply on protective atmosphere composition in welded installation.** Butylkin, B.B.; Shchavelev, L.N.; Prokhorova, L.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE89012167/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(20).

Influence of construction of current and gas supply to a burnes on the purity of argon, passing through it is investigated. The experiments conducted testify to inefficiency of using combined gas and current supplies in welded installations. The obtained dependences are presented. Recommendations on sustaining composition of protective gas when using combined current and gas supply are given. 2 refs.; 3 figs.

36566 (INIS-SU–95, pp. 45-50) **New generation of welded semiautomatic for production of structures out of steels and aluminium alloys.** Belousov, A.N.; Poloskov, S.I.; Efanov, V.A.; Sedov, Yu.S.; Bukhta, O.Ya. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE89012167/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(20).

Analysis of the type of semiautomatic welding machines, produced in our country and abroad, is presented. New designs, realized in the 80th, are described. Design of KOMBI-500 and PRM-4M semiautomatic welding machines is described. 8 refs.; 3 figs.; 1 tab.

36567 (INIS-SU–95, pp. 3-8) **On the properties of new corrosion-resistant high-strength steel 06Kh17G19N3AB and it welded joints.** Zakharov, Yu.V.; Roshchin, V.V.; Rumyantseva, L.E.; Fedyakin, P.N.; Semakin, I.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE89012167/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(20).

Consideration is given to results of investigation of weldability, mechanical and corrosion properties of welded joints, as well as metallographic investigations of a new 03Kh17G19N3AB (AS-43N) steel with low nickel content. AS-43N steel is welded satisfactorily by argan-arc, electric arc, submerged arc welding and is suitable for application at temperatures up to 350 deg C. 3 refs.; 5 figs.; 4 tabs.

36568 (INIS-SU–95, pp. 25-28) **Diffusion at explosion welding of titanium with steel.** Gul'bin, V.V.; Ryabchikov, E.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE89012167/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(20).

Diffusion in titanium-steel bimetal at explosion welding was investigated. It was established that metal mass transfer took place, most activelyfrom lower plate to the upper one by mutualdiffusion with high speed and preliminarily due to elevation of defect concentration in crystal lattice. 6 refs.; 2 figs.; 2 tabs.

36569 (INIS-SU–95, pp. 50-53) **Introduction of experience of television information-control systems in welding.** Lifshits, M.L.; Lobanova, N.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE89012167/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(20).

Consideration is given to peculiarities of using television measuring system for operative control of electron-beam welding of articles with minimum joint gap. It is shown that improvement of control accuracy requires mounting and tuning of television sensors and providing for process procedure. 3 refs.; 1 fig.; 1 tab.

36570 (INIS-SU–95, pp. 14-17) **Methods of deformation estimation of weldpool surfaces from action of localized pressure under through fusion.** Ishchenko, Yu.S.; Khas'yanova, G.L.; Bukarov, V.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE89012167/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(20).

Method for estimating deformation of upper and lower pool surfaces from the action of gas-dynamic jet is suggested. Effect of jet parameters (pressure and affected zone) on surface deformation is shown. 5 refs.; 5 figs.

36571 (Jul–2244) **Fracture mechanics investigations for components of the steam cycle in an HTR electricity producing plant.** Roedig, M.; Pfaffelhuber, M.; Klomfass, J.; Schubert, F.; Nickel, H. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe. Nov 1988. 104p. (In German). Order Number DE89788399/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

Investigations on the fracture mechanics behaviour of X10 NiCrAlTi 32 20 (Alloy 800) have been performed at temperatures of 550^{0}C and 700^{0}C. These investigations were part of the safety philosophy for the steam cycle of a power producing HTGR-plant. An emphasis was laid on the demonstration of the transferability of creep and fatigue crack growth laws. The fatigue crack growth data measured with several standard specimens are in good agreement. So it can be assumed, that a description of the fatigue crack growth by means of the linear-elastic ΔK_I-parameter is valid. In addition an experiment was performed with a thick walled tube in four point bending, containing a non through wall circumferential crack. By several approximation methods a conservative estimation of the fatigue crack growth in this tube is possible. The creep crack growth in standard specimens is well described by the energy rate integral C*. The linear-elastic description by means of K_I gives a large scatter of data, hence K_I seems not to be a valid parameter for the description of the creep crack growth. In thin walled heat exchanger tubes with circumferential cracks in tension, the fatigue crack growth very roughly can be described by means of the ΔK_I-parameter. This is valid although the formal suppositions are not fulfilled. The failure stress for these tubes in tensile loading is described conservatively by means of the Battelle formula.

36572 (LA-UR–89-1241) **Polycrystal plasticity as applied to the problem of in-plane anisotropy in rolled cubic metals.** Rollett, A.D.; Stout, M.G.; Kocks, U.F. Los Alamos National Lab., NM (USA). 1989. 4p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890772–1: Plasticity '89: international symposium on plasticity, Ton, Japan, 31 Jul - 4 aug 1989). Order Number DE89011181/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A fundamental property of cubic metals is that slip occurs on close-packed planes in close-packed directions, which for the f.c.c. case results in 12 {111}<110> slip systems. This crystallographic restriction on the plastic behavior causes significant crystallographic preferred orientation (texture), hence anisotropy, to develop once a large strain has been imposed. Moreover, whereas annealing can generally "reset" the flow stress and ductility, it does not generally randomize the texture: therefore most metallic materials have some degree of texture and consequent anisotropy. The problem of earing in deep drawing can be simply related to the variation of r-value with angle from the rolling direction, i.e. the in-plane anisotropy of the sheet. The r-value can be calculated from a given texture with the use of a polycrystal plasticity model. The Los Alamos polycrystal plasticity (LApp) code is based on the Bishop-Hill single crystal yield surface (SCYS) but with a mildly strain-rate sensitive modification where the stress exponent is of order 30. This modification of the SCYS removes the ambiguity of slip system selection inherent in the Bishop-Hill formulation and permits other phenomena to be treated such as latent hardening and pencil glide. The use of LApp to simulate texture formation and consequent anisotropy is described. Experimental textures in the form of X-ray pole figures are analyzed with a Williams-Imhof-Matthies-Vinel (WIMV) code, as implemented by Kallend, to give full orientation distributions (OD's). The OD obtained this way contains approximately 5000 points on a 5° by 5° lattice; this is used to assign weights to approximately 1000 discrete orientations for calculations with LApp. 11 refs., 2 figs.

36573 (LA-UR–89-1423) **The response of single crystal and polycrystal nickel to quasistatic and shock deformation.** Follansbee, P.S.; Gray, G.T. III. Los Alamos National Lab., NM (USA). 1989. 4p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890772–2: Plasticity '89: international symposium on plasticity, Ton, Japan, 31 Jul - 4 aug 1989). Order Number DE89011168/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Stress-strain measurements and TEM observations in shock-deformed nickel single and polycrystalline samples are reported. When the stress measurements are normalized by the appropriate Taylor factor, the shock induced strain hardening is shown to be similar in all materials studied. 6 refs., 1 fig., 1 tab.

36574 (LBL–25831) **Observations on the mechanisms of fatigue in eutectic Pb-Sn solder joints.** Tribula, D.; Grivas, D.; Frear, D.R.; Morris, J.W. Jr. Lawrence Berkeley Lab., CA (USA). Aug 1988. 22p. DOE Contract AC03-76SF00098. (CONF-881120–10: ASME winter annual meeting, Chicago, IL, US, November 28, 1988). Order Number DE89000553/JAW. Available from NTIS, PC A03/MF A01.

Near-eutectic Pb-Sn solders are widely used for joints in electrical devices. These are liable to failure by thermal fatigue during operation of the device. Since the thermal fatigue load is often in shear, the mechanisms of thermal fatigue in shear fare of particular interest. Recent research has shown that the thermal fatigue of eutectic solders in shear is preceded by the formation of bands of coarsened material in the eutectic microstructure, which concentrate the deformation and cause the nucleation of fatigue cracks. Such coarsened bands are also observed in isothermal fatigue and unidirectional creep in shear. Since creep experiments are relatively simple to conduct and analyze, these have been used to study the formation and growth of coarsened bands. The mechanism includes three steps: the formation of inhomogeneous shear bands, the onset of recrystallization in the shear band to create a planar region of coarsened material, and the propagation of the coarsened band by progressive recrystallization at its tip. The results are applied to thermal fatigue and some of their implications are discussed. 12 refs., 12 figs.

36575 (LBL–26942) **History of the application of the generalized Lewis acid-base theory to metals.** Brewer, L. Lawrence Berkeley Lab., CA (USA). Nov 1988. 6p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8809360–1: World material congress, Chicago, Illinois, USA, 24-26 Sep 1988). Order Number DE89012992/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The history of my experiences with intermetallics has been found useful by students seeking my advice on which directions in science they should be emphasizing. In response to their question, I point to a mobile in my office consisting of seven hands pointing in different directions. Science comes up with so many unexpected developments that one's education should have a broad enough base to allow one to branch out in any direction to take advantage of unexpected opportunities. My historical presentation will be a personal account that I hope will serve as a guide to students. There have been many unexpected abrupt changes in my research.

36576 (LBL–27271) **Vertical gradient freeze GaAs: Growth and electrical properties.** Galiano, M.L. Lawrence Berkeley Lab., CA (USA). May 1989. 66p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE89014894/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

We have investigated the influence of silicon contamination prevention methods on the electrical properties of GaAs grown by the Vertical Gradient Freeze (VGF) technique. We report the effectiveness of these methods for GaAs crystals grown from two different starting materials: n-type with resistivities in the range of 10^{-1} to 10^3 Ω-cm and semi-insulating (SI) with a resistivity of 10^8 Ω-cm. We have found that the impurities in the starting materials, specifically boron, carbon and silicon, have an effect on the ability to control silicon contamination with methods that have been reported previously in the literature. We also report the attainment of SI crystals using a PBN crucible, a SI charge and B_2O_3 encapsulation. 61 refs., 13 figs., 7 tabs.

36577 (MTI–88-TR-10) **Heat exchanger development for steam-injected Brayton cycle: Final report for period September 30, 1984 to April 30, 1988.** Cain, W.G. Mechanical Technology, Inc., Latham, NY (USA). Apr 1988. 184p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG02-84CE40690. Order Number DE89012687/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

A steam-injected, externally fired, gas turbine power cycle offers advantages over other cycles for the cogeneration of process steam and electric power, utilizing nonpremium solid fuels. One aspect of

this innovative cogeneration cycle gives rise to a need for technology not yet available, heating a mixture of compressed air and steam to 1500°F in an externally fired air heater, prior to expansion through a power turbine. Under this program, funded by the Department of Energy (DOE) and the New York State Energy and Research Development Authority (NYSERDA), Mechanical Technology Incorporated investigated the interaction of common phosphate and hydroxide with typical high-temperature heat exchanger materials in the 1500°F operating environment to determine the expected life of the heat exchanger based on the measured corrosion rate. The program consists of a performance study, a 1000-hr screening test of three heat exchanger materials and three water treatment systems, and a 4000-hr endurance test. This report details the results of the performance study that describes several methods of increasing system efficiency, of the 1000-hr screening test in which 347H stainless steel combined with the coordinated phosphate water treatment system was slightly favored at 1350°F, and of the 4000-hr endurance test in which Incoloy 800H was found to have the least amount of corrosion and erosion at 1500°F. 7 refs., 69 figs., 23 tabs.

36578 (NUREG/CR–5216-Rev.1) **Post-irradiation fracture toughness characterization of four lab-melt plates: Revision 1.** Hiser, A.L. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Materials Engineering Associates, Inc., Lanham, MD (USA). Jun 1989. 104p. Sponsored by Nuclear Regulatory Commission. (MEA–2311-Rev.1). Available from NTIS, PC A06/MF A01 - GPO - OSTI.

Previous work indicated that the irradiation-induced transition temperature elevation (ΔT) evaluated from Charpy-V (C_v) data at the 41 J (30 ft-lb) level can give a nonconservative estimate of the ΔT of the static fracture toughness (K_{Jc}) curve at the 100 MPa$\sqrt{m}$ (91 ksi$\sqrt{in.}$) level. This trend was most evident for base metals (plate and forging). The present study looked at the effect of the chemical composition on the relationship between ΔT and C_v and ΔT from K_{Jc}. Four steel plates, having different contents of copper, nickel and phosphorus for different degrees of radiation sensitivity, were used. Static fracture toughness, C_v and tensile tests of the unirradiated and the irradiated conditions were made. In addition, rapid load fracture toughness and drop weight tests of the unirradiated condition were made. The results for the four plates indicate that the correspondence between ΔT from C_v and ΔT from K_{Jc} is not affected significantly by differences in copper, nickel and/or phosphorus content. In each data set, the ΔT from C_v underestimates the ΔT from K_{Jc} measured by C tests. 11 refs., 51 figs., 40 tabs.

36579 (NUREG/CR–5238) **Development of an engineering definition of the extent of J singularity controlled crack growth.** Joyce, J.A.; Hackett, E.M. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Naval Academy, Annapolis, MD (USA); David Taylor Research Center, Annapolis, MD (USA). May 1989. 32p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A03/MF A01 - GPO - OSTI.

An experimental definition is proposed for the extent of singularity controlled behavior in a J-resistance fracture test. The singularity zone is defined in terms of a constant ratio of plastic crack opening displacement and normalized crack extension. Justification for this definition is given in terms of experimental results on compact specimens of three steel alloys of varying material toughnesses and in terms of a simple analytical model. The experimental limit can be evaluated from the data normally obtained during an unloading compliance single specimen J integral resistance curve experiment. Generally the experimental singularity limit extends the region of test validity well beyond that which is presently allowed by the ASTM J-R test standard, E1152. 15 refs., 17 figs., 3 tabs.

36580 (PNL-SA–16211) **Theoretical analysis of phase transformations in Fe-Ni "Invar"-type alloys.** Russell, K.C.; Garner, F.A. Pacific Northwest Lab., Richland, WA (USA). Feb 1989. 33p. Sponsored by DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-8902117–1: Symposium on physical metallurgh of controlled expansion invar- type alloys, Las Vegas, NV, USA, 28 Feb 1989). Order Number DE89014454/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Many studies have suggested that Fe-Ni and Fe-Ni-Cr alloys of ca. 35 at. % Ni are susceptible to decomposition into two FCC phases. We herein model the kinetics and thermodynamics of spinodal decomposition, nucleation, growth, and coarsening of these alloys. Prediction of the scale of a microstructure formed by growth or coarsening may be done with some confidence. The absence of a model for surface energy and gradient energy in systems with negative departure from ideality reduce us to little more than guesses for the kinetics of nucleation and of spinodal decomposition. We combine our calculations with those of others and studies of terrestrial and celestial decomposition to suggest a miscibility gap for Fe-Ni alloys. The gap is very narrow at high temperatures but is broadened at low temperatures by magnetic effects. 29 refs., 15 figs.

36581 (RFP-Trans–500) **Studies on work-softening processes in the hot forming of austenitic steel.** Buehler, H.; Bobbert, D.; Rose, A. 21p. Translated from Stahl und Eisen (F.R. Germany). *Stahl und Eisen (F.R. Germany),* 90(1): 21-28 (1970). Sponsored by DOE Defense Programs. DOE Contract AC04-76DP03533.

Studies on the phenomena of stress relieving in the hot shaping of austenitic steel. Material examined: austenitic steel X 10 CrNiTi 18 10 containing about 0.05% C, 0.4% Si, 1.5% Mn, 17.6% Cr, 11.0% Ni and 0.3% Ti. Investigation of the progress of stress relieving after hot shaping by upsetting in the temperature range of 900 to 1200°C with deformation rates of 25.50 to 75% within the period of 2 and 150 seconds after deformation. Tracing of the processes of relaxation, polygonization and recrystallization by hardness measurements, structure and texture examinations, measurement of the deformation stress in the interrupted upsetting process and electron-optical observations. 17 refs., 10 figs.

36582 (SAND–87-1249) **A method of removing oxides from the surface of Fe-Ni-Co alloy particles by chemical etching.** Yelton, W.G. Sandia National Labs., Albuquerque, NM (USA). Apr 1989. 27p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89014597/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The addition of metal particles to bulk glass has been shown to increase fracture strength and toughness. Composites containing well-bonded particles exhibit the largest increases in these properties. This report discusses a study in which a method was developed to alter the surfaces of Fe–Ni–Co particles so that improved particle/glass matrix bonding resulted. In this method, as received Fe–Ni–Co particles were intentionally oxidized to create surface and grain boundary oxides. The surface and grain boundary oxides were then preferentially removed from the surfaces of iron-nickel-cobalt alloy particles by chemical etching. After removal of the surface oxides, coral-like structures remained on the surfaces of the metal particles and furnished good mechanical bonding sites to the glass matrix. The progression of this study involved completion of three designed experiments. In the first experiment, an etching process was identified by controlling etching solution temperature and hold time. Data from the first study were then incorporated into the design of a second experiment which examined solution temperature heating rate and hold time at 60°C. Finally, the best conditions of the previous studies were selected to investigate the effects of the agitation rate of the etching solution on the particle yield. Combining the best conditions from each study yielded the most efficient method of removing oxides, in which a solution of 120 ml/l H_3PO_4 and 50 ml/l HCl was heated at 1°C/min to 60°C, held at 60°C, and then moderately agitated for 30 min. 6 refs., 18 figs., 2 tabs.

36583 (SAND–88-0973C) **Mechanisms that control the geometry of pulsed Nd:YAG laser welds.** Jellison, J.L.; Russo, A.J.; Peebles, H.C.; Williamson, R.L. Sandia National Labs., Albuquerque, NM (USA). 1988. 24p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8810176–5: JOWOG 22D joining subgroup, Aldermasten, UK, 4-6 Oct 1988). Order Number DE89014490/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A two-dimensional conduction laser welding code developed by Russo overpredicted the geometry of pulsed welds for welding parameters typically used in production. At low heat fluxes, however, there was good agreement between the experimental results and the welding code. The limitations of the code appear to result from ignoring some of the important physics of the laser welding processes. Subsequent experimental process research and further

efforts have concentrated on beam-plume interactions and weld pool convection. A key experiment that has been used in testing the physical models is one where the role of a surface active element in controlling the geometry of austenitic stainless steels welds was evaluated. This experiment involved a significant range of heat fluxes and addressed the role of the laser plume. In this paper, both experimental and theoretical studies of the laser plume are discussed. Furthermore, the role of surface tension-driven convection (Marangoni flow) is explored. The results of this research are used to explain the geometry of austenitic stainless steel welds from the above experiment. 8 refs., 7 figs.

36584 (SAND–89-0506C) **Diamagnetic shielding and flux creep in a Tl-Ba-Ca-Cu-O thin film.** Venturini, E.L.; Kwak, J.F.; Ginley, D.S.; Baughman, R.J.; Morosin, B. Sandia National Labs., Albuquerque, NM (USA). 1989. 2p. Sponsored by DOE Energy Research. DOE Contract AC04-76DP00789. (CONF-890718–6: International conference on materials and mechanisms of superconductivity - high-temperature superconductors, Stanford, CA, USA, 23-28 Jul 1989). Order Number DE89014550/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Static magnetization data for a superconducting thin film based on the Tl-Ba-Ca-Cu-O system are presented and discussed. The film, deposited by electron-beam evaporation onto a single crystal $SrTiO_3$ substrate, consists of large grains of two superconducting structural phases with their crystallographic c axes normal to the substrate. It exhibits substantial transport critical current density, large diamagnetic shielding, and activated flux creep, consistent with strong intergranular links but weak flux pinning. 7 refs., 2 figs.

36585 (SAND–89-0521) **A test system for thermomechanical fatigue of solder joints.** Schmale, D.T.; Frear, D.R. Sandia National Labs., Albuquerque, NM (USA). Jun 1989. 26p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89013886/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The thermomechanical fatigue behavior of solder joints is a critical reliability issue in electronic packaging. A need exists for a thorough metallurgical understanding of solder joints in conditions of thermal fatigue. This paper presents a method to test solder joints under conditions of thermomechanical fatigue. This method involves simultaneous imposition of temperature and strain cycles on discrete solder joints in a shear orientation. The stress, microstructure, and number of cycles to failure are monitored. Cycles to failure are determined by a continuous electrical resistance detection method. 60Sn-40Pb and 40Sn-40In-20Pb solder joints were tested using this new method at 20% shear strain. 4 refs., 7 figs.

36586 (SAND–89-0815C) **Thermal strains in a bimaterial joint: Experimental and numerical analysis.** Wood, J.D.; Tsai, M.Y.; Post, D.; Morton, J.; Parks, V.J.; Gerstle, F.P. Jr. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by Department of Defense. DOE Contract AC04-76DP00789. (CONF-8905107–4: SEM spring meeting, Cambridge, Massachusetts, USA, 28 May - 2 jun 1989). Order Number DE89013935/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A comprehensive stress analysis was performed for a bimaterial plate subjected to a uniform change of temperature. The steel and brass portions of the specimen were bonded along a common edge. Whole-field measurements were made by high-sensitivity moire interferometry. A companion finite element numerical analysis of a similar body was conducted to help interpret the experimental results. The experiments documented a strong free-edge effect along the entire perimeter of the joint, an effect akin to a line singularity along the perimeter. High stresses in the edge-effected zone were determined from measurements, and enormous stress gradients were deduced by analysis. The largest stresses were found at the corner, where two edge-effected zones intersected. 5 refs., 8 figs.

36587 (UCRL–101189) **PFMS [Precision Flexible Manufacturing System] tool characterization study at Lawrence Livermore National Laboratory.** Hansen, H.J.; Prokosch, M.W. Lawrence Livermore National Lab., CA (USA). 2 Jun 1989. 35p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8906136–1: Machine tool subgroup spring meeting, Pinnellas, FL, USA, 6-8 Jun 1989). Order Number DE89013775/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A tool characterization study was conducted as part of the modeling effort at LLNL in support of the Y-12 Enhanced T-base Project. The goal of the study was to identify tool error sources and measure their influence on the finish machining process of D-38 Hemi Shells. This paper outlines the procedures and results of this study. The condition of new carbide inserts used at Y-12 are examined including insert edge quality, geometry, and tool radius size and contour deviation. Test parts were cut on LLNL's Pneumo Precision T-Base lathe according to common Y-12 finishing procedures. Part profile and tool contour were measured before and after each cut. The effect of initial tool profile errors and tool wear during the cut are discussed as they relate to the finished part profile. Insert and part inspection procedures are covered in detail. The established tool wear patterns for both the .002" and the .005" depths of cut typically used at Y-12 are presented. Additional tool error source observations are also included. 22 figs.

36588 (WHC-SA–0536) **Creep-fatigue assessment methods using elastic analysis results and adjustments.** Severud, L.K. Westinghouse Hanford Co., Richland, WA (USA). Mar 1989. 10p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-890721–30: Joint ASME/JSME pressure vessel and piping conference, Honolulu, Hawaii, USA, 23-27 Jul 1989). Order Number DE89011858/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The design of mechanical components that operate in elevated temperature environment where creep effects are significant usually requires creep-fatigue assessments. The ASME Code Case N-47 contains rules for these assessments based on both inelastic and elastic stress analysis. Although an inelastic stress analysis generally more accurately predicts effects from creep and plasticity, an elastic analysis is often preferred since it is much simpler and less costly. New creep-fatigue rules for use with elastic analysis results have recently been proposed to enhance the rules' accuracy and usefulness. This paper describes such new methods and rules for creep-fatigue assessments. Ingredients of the new methods include elastic follow up, ratcheting, multiaxiality, plasticity, creep, and relaxation considerations and associated adjustment factors. The basis for the adjustments and a comparison of results to those obtained using inelastic analysis are provided. The new methods will provide a wide range of practical application of elastic creep-fatigue rules than permitted by previous code methods in design of components for elevated temperature service. 21 refs., 13 figs.

36589 **Proceedings of the 3rd Berkeley conference on corrosion-erosion-wear of materials at elevated temperatures.** Levy, A.V. 396p. National Assoc. of Corrosion Engineers, Houston, TX (1987). (CONF-860104–: 3. Berkeley conference on elevated temperature corrosion-erosion-wear of materials, Berkeley, CA, USA, 27-29 Jan 1986).

This book contains 26 selections. Some of the titles are: Oxygen-sulfur corrosion of metals in mixed-gas atmospheres; Ceramic thermal barrier coatings for electric utility gas turbine engines; Erosion of ceramics; Erosion studies with fluid catalytic cracking catalysts and Effects of material and test variables on abrasion.

36590 **Metallurgical aspects of crack-tip failure processes.** Gerberich, W.W. (Chemical Engineering and Materials Science, Univ. of Minnesota, Minneapolis, MN (US)). v.v of Proceedings of the eighteenth national symposium on fracture mechanics. Read, D.T.; Reed, R.P. ASTM, Philadelphia, PA (1988). (CONF-850679–: 18. American Society for Testing and Materials national symposium on fracture mechanics, Boulder, Colorado, USA, 25-27 Jun 1985).

Process zone models for fracture of fiber-reinforced concrete, metal-particle reinforced glass, and polymer crazes have good experimental verification. This is because the microfracture process zone is often macroscopic in size or easily identifiable or both. Similar models have been proposed for metals and ceramic microstructures. This paper addresses how the microfracture process zone develops in such microstructures. Specifically, the microcrack evolution process may be controlled by chemistry and microstructure as well as localized stress distributions. The importance of this is that the microcrack distribution and the energy dissipation process in the remaining ligaments behind the advancing crack front

control the R-curve and final fracture instability. Examples of R-curve behavior in ductile fracture and semibrittle composites are shown, and a model for brittle fracture of steel is proposed. The latter shows that a semi-cohesive process zone of variable size and strength may represent an approach to brittle fracture where weakest-link models are not applicable. Predictions of fracture toughness for ferrite/pearlite steels as a function of test temperature and grain size are obtained with such an approach.

36591 Cracking of Alloy 800 tubing in superheated steam sections of the solar one central receiver. Lippold, C. (Sandia National Labs., Livermore, CA (US)). v.v of Corrosion '85. National Assoc. of Corrosion Engineers, Houston, TX (1985). (CONF-850311–: National Association of Corrosion Engineers annual meeting and materials performance and corrosion show, Boston, MA, USA, 25-29 Mar 1985).

Severe cracking has been observed in tube bend regions of receiver tubes which operate in the temperature range from 550 to 650^{0}C. The cracks initiate in the crown of the tube bend on the tube I.D. and propagate transgranularly through the tube wall. The paper describes the metallurgical and mechanical issues which are responsible for these premature failures.

36592 Role of residual stress in stress corrosion cracking in Alloy 600 tubes - Part I. Bandy, R. (Brookhaven National Lab., Upton, NY (US)); Zemanian, T. v.v of Corrosion '85. National Assoc. of Corrosion Engineers, Houston, TX (1985). (CONF-850311–: National Association of Corrosion Engineers annual meeting and materials performance and corrosion show, Boston, MA, USA, 25-29 Mar 1985).

The effect of transient heat treatment on throughwall residual stress distribution of cold worked Alloy 600 tubes has been investigated, using electrochemical machining coupled with Sachs analyses for residual stress calculations. Heating for 60 to 150 seconds at 775-850 C causes significant reduction of the magnitude of the stress, and modification of the stress distribution, and thus improves resistance to stress corrosion cracking.

36593 Stress corrosion cracking susceptibility of types 316NG and 316 stainless steel in BWR-type environments. Maiya, P.S. (Argonne National Lab., Argonne, IL (US)); Shack, W.J. v.v of Corrosion '85. National Assoc. of Corrosion Engineers, Houston, TX (1985). (CONF-850311–: National Association of Corrosion Engineers annual meeting and materials performance and corrosion show, Boston, MA, USA, 25-29 Mar 1985).

The relative stress corrosion cracking (SCC) susceptibility of Types 316NG and 316 stainless steel has been investigated by means of constant extension rate tests over a range of strain rate in simulated BWR environments that contain impurities. The impurity and strain-rate effects are discussed in terms of a phenomenological model.

36594 Effect of temperature and ionic impurities at very low concentrations on stress corrosion cracking of sensitized type 304 stainless steel. Kassner, T.F. (Argonne National Lab., Argonne, IL (US)); Ruther, W.E.; Soppet, K. v.v of Corrosion '85. National Assoc. of Corrosion Engineers, Houston, TX (1985). (CONF-850311–: National Association of Corrosion Engineers annual meeting and materials performance and corrosion show, Boston, MA, USA, 25-29 Mar 1985).

Effect of temperature on the SCC behavior of lightly sensitized Type 304 SS was investigated in CERT experiments over the temperature range of 110 to 320 C in high-purity water and in water containing 0.1 and 1.0 ppm sulfate at a dissolved oxygen concentration of 0.2 ppm. The SCC behavior was correlated with the impurity concentration and the open-circuit corrosion potential of the steel.

36595 Atmospheric corrosion and inhibition of copper. Sorensen, N.R. (Sandia National Labs., Albuquerque, NM (US)); Christensen, T.M. v.v of Proceedings of the Electrochemical Society fall meeting. Volume 88-2 (extended abstracts). The Electrochemical Society, Pennington, NJ (1988). (CONF-881061–: Electrochemical Society fall meeting, Chicago, Illinois, USA, 9-14 Oct 1988).

Copper, used extensively in the microelectronics industry, is subject to atmospheric corrosion and tarnishing. Such corrosion can lead to increased contact resistance, open circuits, problems in soldering processes, and additional cleaning cycles during processing. Inhibitors are used routinely to maintain a metallic, untarnished appearance on the copper. A number of organic compounds have been used as corrosion inhibitors for copper in aqueous and atmospheric exposures with varying degrees of success. Two that appear to be particularly effective for copper are benzotriazole (BTA) and tolyltriazole (TTA), which significantly decrease the copper dissolution rate in aqueous environments. The authors are investigating the mechanism by which these organic inhibitors limit oxidation, the effect of atmospheric pollutants (NO_2, H_2S, SO_2, and H_2O) on the inhibition efficiency, and the effects of the inhibitors on manufacturing processes such as soldering. Atmospheric exposures are being run in our Facility for Atmospheric Corrosion testing (FACT) which allows control of the contaminant gasses to concentrations ranging from several ppb to several ppm. Work on Cu inhibition by organic inhibitors (benzotriazole, BTA) has led to the development of a model that describes both the inhibition results and the solderability data following the application of the inhibitor.

36596 The preparation of mechanically alloyed powders for TEM examination. Kamenetzky, E.A. (Materials and Chemical Sciences Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)); Wall, M.; Castro, R; Tanner, L.E. v.v of Specimen preparation for transmission electron microscopy of materials. Bravman, J.C.; Anderson, R.M.; McDonald, M.L. Materials Research Society, Pittsburgh, PA (1988). (CONF-871297–: Symposium on specimen preparation for transmission electron microscopy of materials, Boston, Massachusetts, USA, 3 Dec 1987).

TEM specimens of mechanically alloyed elemental Ni and Nb powders are prepared by a new procedure. The alloyed powders are mixed with smaller Al powders and fill an aluminum ring (3mm outer diameter). This composite is cold pressed together with the Al powders taking most of the deformation. The compacted specimen can be mechanically thinned. Electropolishing and ion milling can then proceed by standard methods with special precautions to minimize differential polishing or milling rates. The microstructural aspects of the formation of an amorphous phase by high-energy ball milling these powders have been studied. After 6 h each particle transforms to a heterogeneous layered composite of particles of one element in the matrix of the other. Particle size ranges from 15 nm to 90 nm. Mechanical alloying for 36 h results in the formation of an apparently uniform phase interspersed with a few small (4 nm to 30 nm) elemental crystalline particles. The uniformity of composition and the presence of C, O, and Fe were studied by EDX and EELS.

36597 The failure of aluminum compact shear specimens under mixed-mode loading. Riddle, R.A. (Lawrence Livermore National Lab., Livermore, CA (US)); Streit, R.D.; Finnie, I. v.v of Proceedings of the eighteenth national symposium on fracture mechanics. Read, D.T.; Reed, R.P. ASTM, Philadelphia, PA (1988). (CONF-850679–: 18. American Society for Testing and Materials national symposium on fracture mechanics, Boulder, Colorado, USA, 25-27 Jun 1985).

The failure behavior of 7075-T6 aluminum under mixed-mode loading was investigated using the compact shear specimen. This specimen is capable of providing a range of Mode I and Mode II loading conditions at the crack tip, depending upon the boundary conditions provided by the loading fixtures. Finite-element analyses of the specimen were made which included the effects of loading fixture constraints and the material's elastic-plastic properties. The symmetric and antisymmetric components of the stress and deformation fields were used to calculate the applied J-integral values, J_I and J_{II}, corresponding to the Mode I and Mode II loading at the crack tip. Methods to obtain the critical values of the J-integral at crack initiation from the load displacement curves of the specimen are discussed. The failure behavior of the material varied greatly depending upon the relative amounts of Mode I and Mode II loading at the crack tip. For near Mode I loading, the specimen behavior at failure loads was nearly elastic, and the failure processes appeared to be typical of those for Mode I plane-strain fracture toughness testing. A fairly significant amount of shear loading seemed to have little effect on the failure load. For near Mode II loading, the amount of plastic deformation is much more significant, with the ligament

ahead of the crack tip nearly fully plastic at the failure load. The failure processes in the material, as evidenced by the fracture surface morphology, are different as compared to Mode I type failure. There is evidence of slow stable crack growth occurring at loads near the departure from linearity of the specimen load-displacement curve.

36598 Developments in the TEM examination of Pu and Pu alloys. Zocco, T.G. (Materials Science and Technology Div., Los Alamos National Lab., Los Alamos, NM (US)); Rohr, D.C. v.v of Specimen preparation for transmission electron microscopy of materials. Bravman, J.C.; Anderson, R.M.; McDonald, M.L. Materials Research Society, Pittsburgh, PA (1988). (CONF-871297–: Symposium on specimen preparation for transmission electron microscopy of materials, Boston, Massachusetts, USA, 3 Dec 1987).

Microstructural characterization of plutonium utilizing Transmission Electron Microscopy (TEM) has previously been difficult because of the extreme toxicity and high oxidation rate of plutonium metal. Recent developments in plutonium sample preparation have shown that foils of both alpha and delta phases of plutonium may be prepared for TEM without the use of inert atmospheric systems or complex preparation devices. Samples may be produced, using standard electropolishing techniques, that yield important microstructural data on plutonium and plutonium alloys.

36599 Preparation of in situ Cu-Nb composite sheet and wire for TEM analysis. Trybus, C.L. (Ames Lab., USDOE, Iowa State Univ., Ames, IA (US)); Laabs, F.C.; Spitzig, W.A.; Pelton, A.R. v.v of Specimen preparation for transmission electron microscopy of materials. Bravman, J.C.; Anderson, R.M.; McDonald, M.L. Materials Research Society, Pittsburgh, PA (1988). (CONF-871297–: Symposium on specimen preparation for transmission electron microscopy of materials, Boston, Massachusetts, USA, 3 Dec 1987).

Cu-Nb in situ composites attain anomolous increases in strength upon mechanical deformation. The unique filamentary microstructures that evolve during processing (cold rolling and/or wire drawing) are the source of the strengthening. Results from transmission electron microscopy characterization studies have played a key role in the understanding of the relationships between structure and properties. However, the fabrication of reliable TEM samples has been extremely challenging for the following reasons: traditional electrochemical techniques are not suitable for the two-phase microstructure, preparation of longitudinal and transverse sections of fine (–150 μm diameter wires) and thin (–60 μm thick) sheet is tedious, and it is necessary to avoid excessive heat (< 30^0C) during sample preparation to preserve the metastable structural arrangements. This paper reviews the procedures used to prepare TEM specimens from bulk wire and sheet samples as well as from extracted Nb filaments. Proper techniques for plating, mounting, sectioning, polishing, and ion-thinning are discussed.

36600 Preparation of thin-foil TEM specimens from submillimeter particulate. Kelly, T.F. (Dept. of Metallurgical and Mineral Engineering, Univ. of Wisconsin, Madison, WI (US)); Libera, M.R.; VanDerSande, J.B. v.v of Specimen preparation for transmission electron microscopy of materials. Bravman, J.C.; Anderson, R.M.; McDonald, M.L. Materials Research Society, Pittsburgh, PA (1988). (CONF-871297–: Symposium on specimen preparation for transmission electron microscopy of materials, Boston, Massachusetts, USA, 3 Dec 1987).

The particulate produced by many of the methods of rapid solidification, such as atomized powder, is of order 50 microns in diameter and is thus much too small to form the 3mm diameter disc conventionally used for thin-foil microscopy. 50 microns is, however, much too thick for direct TEM study on a support film and grid. A technique is described in detail that produces a composite wafer where atomized metal powder is sandwiched between two layers of electroplated nickel. This wafer is about 25 mm in diameter and about 250 microns thick. 3mm diameter TEM discs can be punched from the wafer and thinned by combinations of grinding, dimpling, jet-polishing, and ion milling. Depending on the composition and structure of the power under study, the composite nature of the wafer can sometimes promote undesirable galvanic effects during jet polishing and differential thinning rates during ion-milling. Typical results are presented and discussion of the benefits and shortcomings of this technique is made. The method should be applicable to a variety of materials and geometries.

36601 Evaluating the intergranular SCC resistance of sensitized Type 304 stainless steel in low-temperature water environments. Bruemmer, S.M. (Battelle Pacific Northwest Lab., Richland, WA (US)); Jones, R.H.; Divine, J.R.; Johnson, A.B. Jr. v.v of Environment-sensitive fracture: Evaluation and comparison of test methods. Dean, S.W.; Pugh, E.N.; Ugiansky, G.M. ASTM, Philadelphia, PA (1984). (CONF-820495–: ASTM symposium on environment sensitive fracture: evaluation and comparison of test methods, Gaithersburg, MD, USA, 25-28 Apr 1982).

The resistance of sensitized AISI Type 304 stainless steel to intergranular stress corrosion cracking (IGSCC) in 32^0C water environments has been investigated by using constant axial load (CAL), constant extension rate (CER), U-bend, and crevice corrosion tests. Constant load tests were found to give a better simulation of a service failure and produced IGSCC under a wider range of conditions than CER or U-bend tests. Intergranular SCC of welded and furnace-sensitized Type 304 specimens was observed in CAL experiments in both deionized and borated water with ppm level chloride additions. Constant extension rate tests also produced IGSCC, but only in welded pipe specimens with the original ground and welded surfaces intact. If the original inner diameter and outer diameter surfaces were removed, fracture surfaces showed ductile, microvoid coalescence appearances. No evidence of SCC or significant corrosive attack was found in U-bend or crevice corrosion tests after more than six months in dilute chloride environments at temperatures of 30 or 50^0C. However, intergranular cracking was observed in furnace-sensitized, high-carbon Type 304 U-bend specimens at 80^0C.

36602 Specimen thickness effects for elastic-plastic CTOD toughness of an A36 steel. Wellman, G.W. (Sandia National Labs., Albuquerque, NM (US)); Sorem, W.A.; Dodd, R.H. Jr.; Rolfe, S.T. v.v of Proceedings of the eighteenth national symposium on fracture mechanics. Read, D.T.; Reed, R.P. ASTM, Philadelphia, PA (1988). (CONF-850679–: 18. American Society for Testing and Materials national symposium on fracture mechanics, Boulder, Colorado, USA, 25-27 Jun 1985).

This paper describes the results of an experimental and analytical study of the effect of specimen size on the fracture toughness behavior of A36 steel, primarily in the lower-transition region. This region is beyond the limits of plane strain as defined by ASTM Method E 399, but in the region where failure occurs prior to any macroscopic fibrous tearing. Experimental results were obtained using crack-tip opening displacement (CTOD) three-point bend specimens, and analytical results were obtained using a 3-D elastic-plastic finite-element analysis. Two specimen sizes, full thickness [31.8 mm (1.25 in.)] and reduced thickness [12.7 mm (0.50 in.)], were investigated using the preferred t x 2t x 8t specimen size. Testing was conducted according to the procedure outlined in BS 5672: 1979, Methods for Crack Opening Displacement Testing. CTOD-temperature transition curves were developed for both specimen sizes. A sufficient number of specimens were tested at two temperatures in the lower-transition region to allow statistical characterization of the CTOD results. Both normal and Weibull distributions were used for that characterization. Three-dimensional elastic-plastic finite-element analyses were conducted to determine the effect of specimen size on the near-crack-tip opening stresses through the specimen thickness. The near-crack-tip stress fields were compared at various CTOD levels well into the elastic-plastic regime, but prior to any stable crack growth. At each of the applied CTOD levels, the maximum near-crack-tip opening stress occurred at the specimen centerplane and was found to be essentially independent of specimen size.

36603 Theoretical investigations of phonon anomalies in fcc La and W(001). Wang, X. Thesis (Ph. D.). 85p. Iowa State Univ., Ames, IA (1987). Available from University Microfilms, PO Box 1764, Ann Arbor, MI 48106, Order No.88-05,150.

Studies of the electron-phonon interaction were carried out for fcc La by the efficient tight-binding method. This scheme was then extended and generalized to surface studies. Application of this extended scheme to the W(001) surface provided detailed information about the driving mechanism for surface reconstruction. Together with the further studies on the Mo(001) surface, the investigation

showed very promising potential applications of this scheme to various surface phonon and surface phase-transition studies. For the fcc La, first-principles pseudopotential band-structure calculations were performed and revealed a small but sharp nesting feature of the Fermi surface. The calculations for W(001) p (1x1) surface phonons successfully demonstrated the electronic origin of the c(2x2) surface reconstruction. The reason for the stable M_1 and soft M_5 surface-phonon modes was found to be the dramatic differences in their electron-phonon coupling matrix elements. The subtle interplay between the Fermi surface nesting and real-space d-orbital interaction was found to cause the surface reconstruction. Subsequent studies on the Mo(001) surface further established the relationship between these competing effects and surface reconstruction geometries.

36604 Optical properties of metals and alloys: Au, Ag, FeRh, $AuAl_2$, and $PtAl_2$. Chen, L.Y. Thesis (Ph. D.). 127p. Iowa State Univ., Ames, IA (1987). Available from University Microfilms, PO Box 1764, Ann Arbor, MI 48106, Order No.88-05,054.

The free-electron dielectric functions of Ag and Au films were measured in air and immersed in dielectric liquids of different refractive indices. Measurements of the dielectric functions for FeRh alloys with 48, 50, 52, and 54% Fe concentrations were measured between 25 and 125°C in the 1-3-eV range. Results show that the band structure of FeRh is not drastically affected at the antiferromagnetic (AF) - ferromagnetic (F) phase transition, less than band-structure calculations indicated. Therefore, the large change in the electronic specific heat between the AF and F phases can be attributed primarily to a magnetic contribution rather than to a change in the density of electronic states at the Fermi surface. Finally, dielectric functions of $AuAl_2$ and $PtAl_2$ alloys were measured in the 1.5-5.5-eV range. The spectra of reflectivity, absorption, energy loss function, and joint density of states were obtained and are discussed in detail. The onsets of interband transitions were determined by last-squares fitting to the absorption edges in the spectra of the joint density of states, which could be attributed to transitions between only the s and p bands for both materials.

36605 Developments and trends in electrodeposition. Dini, J.W. (Lawrence Livermore National Lab., CA (USA)). *SAMPE (Society for the Advancement of Material and Process Engineers) Quarterly (USA),* 20(3): 28-32 (Apr 1989). DOE Contract W-7405-ENG-48.

Electrodeposition is a very important technology. Covering inexpensive and widely available base materials with a thin (typically 0.1 to 10 μm) coating with specific properties extends their use to applications which otherwise would have been prohibitively expensive. Furthermore, the ability to provide property control in coatings as thick as 10 mm adds further value to this important technique of surface modification. In recent years a number of advances in areas such as composite plating, pulse plating and high speed plating have added further credence viable coating technology. These branches of the industry are reviewed and future trends are discussed.

36606 Ion-beam studies of hydrogen-metal interactions. Myers, S.M. (Sandia National Labs., Livermore, CA (USA)); Richards, P.M.; Wampler, W.R.; Besenbacher, F. *Journal of Nuclear Materials, on Metallurgy, Ceramics and Solid State Physics in the Nuclear Energy Industry (Netherlands),* 165(1): 9-64 (Apr 1989). DOE Contract AC04-76DP00789.

Experiments utilizing ion implantation and ion-beam analysis have provided a large body of new quantitative information on hydrogen interactions within metal matrices and at metal surfaces. Investigated matrix interactions include trapping by vacancies, vacancy-solute complexes, He bubbles, and oxide precipitates, together with such phase-change reactions as hydride formation, hydrogen-bubble precipitation, and hydrogen reduction of precipitated oxides. Extracted information encompasses mechanisms, binding enthalpies, microstructures, and local atomic configurations. In the area of surfaces, ion-channeling analysis has yielded the lattice positions of chemisorbed hydrogen on a variety of metals. Additionally, ion-implantation experiments have quantified surface-limited uptake and release for bare, chemisorbed, and oxidized metal surfaces. Theoretical studies coupled with the ion-beam experiments have produced advances in four areas of hydrogen behavior. First, effective-medium theory has been shown to yield a quantitative description of hydrogen energies and positions at matrix defect traps and surface chemisorption sites. Second, a new, analytical treatment of trapping kinetics gives quantitative trapping rates for arbitrary trap volume fraction and arbitrary spatial correlation between traps. Third, new theoretical studies of surface barriers have clarified the dominant processes of release for bare, chemisorbed, and oxidized metal surfaces. Finally, general transport formalisms have been developed to predict overall hydrogen behavior in terms of individual matrix and surface processes.

36607 Effect of Y_2O_3 additions on the plasticity of sintered Cr_2O_3. King, W.E. (Argonne National Lab., IL (USA)); Park, J.H.; Routbort, J.L.; Goretta, K.C. *Oxidation of Metals (USA),* 29(3-4): 217-224 (Apr 1988).

The authors have carried their constant strain-rate compression tests on polycrystalline Cr_2O_3 and Cr_2O_3 doped with 0.09 wt.% Y_2O_3 to establish whether there exists an effect of Y_2O_3 on the plasticity of Cr_2O_3. This study is motivated by previous work on the oxidation of alloys containing reactive-element additions. In that work, it has been observed that the addition of oxygen-active elements, such as Y to alloys that form Cr_2O_3 or Al_2O_3 oxide layers upon exposure at high temperature, strongly enhances the adhesion of the oxide layer to the base alloy as compared with alloys without reactive-element additions. They have found that at 1200°C (1) chromia exhibits limited plasticity at high temperatures, and (2) the presence of Y in the oxides does not enhance plasticity compared with addition-free oxides.

36608 Effect of chromium on early stages of oxidation of Ni_3Al alloys at 600°C. Horton, J.A. (Oak Ridge National Lab., TN (USA)); Cathcart, J.V.; Liu, C.T. *Oxidation of Metals (USA),* 29(3-4): 347-366 (Apr 1988).

Initial oxide formation at 600°C in air on Ni_3Al alloys with and without chromium additions was studied by TEM. Significant lateral nickel diffusion (apparently stress-induced) occurred in both alloys producing bands of nickel and nickel-enriched hillocks. Chromium additions clearly alleviate dynamic embrittlement in Ni_3Al; chromium additions were previously assumed to affect the oxidation process. Chromium additions significantly reduced the oxidation rate of the alloy. However, a continuous film of pure Cr_2O_3 had not yet formed after 45 sec oxidation. Grain boundaries preferentially oxidized to form Al_2O_3 or Cr_2O_3 and rejected nickel along both the surface and the grain boundary, deeper into the specimen. The dramatic effect of chromium on improving the ductility of Ni_3Al when tested at high temperature in air is apparently a result of a process that occurs at or near the tip of a propagating crack that is both faster and on a finer scale than that studied here.

3602 Ceramics, Cermets, and Refractories

Refer also to citation(s) 35538, 36447, 36483, 36489, 36498, 36500, 36528, 36542, 36587, 36589, 36590, 36607, 36667, 36688, 36726, 36851, 36897, 36898, 36899, 36900, 36901, 36902, 36904, 36941, 36945, 36947, 36948, 36949, 36950, 36951, 36952, 36953, 36954, 36955, 36956, 37021, 37158, 37692

36609 (AD-A-201483/5/XAB) **Josephson effect research in high-temperature superconductors. Interim report, 30 September 1987-29 September 1988.** Cheng, J.T.; Wenger, L.E. Wayne State Univ., Detroit, MI (USA). Aug 1988. 35p. Available from NTIS, PC A03/MF A01.

The original research proposal to ONR/SDIO had outlined two major goals to be accomplished during the three and half year period from July 1987 to December 1990. The first task was fabrication and characterization of thin-film superconductors with the high-temperature oxide materials; and the second was fabrication and characterization of Josephson tunnel junctions. These tasks included the following: (i) fabrication and characterization of thin film superconductors and (ii) fabrication and characterization of Josephson tunnel junctions. Although the administration/contracting of funds was not formally authorized until January 1988, the progress was quite successful with regards to the first goal of fabrication and characterization of thin/film superconducting oxide films. Similar to all other research groups in being unable to fabricate simple

Josephson tunnel junctions with superconducting oxides, the authors have, however, been unable to initiate some characterization of the electromagnetic response observed in these films due to the inherent granular Josephson-coupled networks. Progress attained in the research proposal to date, a summary of the major accomplishments, and index of publications attributable to the present funding period are outlined, along with the proposed program for continued research.

36610 (AD-A–204630/8/XAB) **Phase relationships in high-temperature ceramics. Phase 1. Final report.** Turcotte, R.P. Flow Research Co., South Kent, WA (USA). Apr 1987. 39p. (FLOW-TR–409). Available from NTIS, PC A03/MF A01.

The objective of this work was to establish an efficient means of determining the high temperature phase behavior of the HfO_2-Ta_2O_5 system under conditions of relevance to their potential use in propulsion system environments. A primary objective was to establish melting temperatures for the mixed oxides and to identify phases formed in the high temperature portions of the phase diagram, above 2500 F (1400 C). The approaches evaluated included traditional anneal quench studies and use of CO_2 laser heating in controlled atmospheres. Melting points were measured using an optical pyrometer/laser fusion approach. Phases formed were characterized primarily by x-ray diffraction and electron microscopy. the liquidous curve for the oxide system has been established and two new phases identified for the oxide system.

36611 (AD-A–204648/0/XAB) **Consolidation of powders of the oxide superconductor YBa_2Cu_3Ox by high energy-high rate processing.** Persad, C.; Lee, S.J.; Peterson, D.R.; Swinnea, J.S.; Schmerling, M. Texas Univ., Austin, TX (USA). 1988. 10p. Available from NTIS, PC A02/MF A01.

Pub. in World Scientific Series on Progress in High Temperature Superconductivity, Vol. 8, 460-475(1988).

The consolidation response of powders of the superconducting compound YBa_2Cu_3Ox is reported. Copper, silver, tin, and Cu-based metallic glass infiltrates have also been employed in preliminary fabricability studies. The processing approach relies on short-duration (< 1s), high-current-density 10000 A/sq.cm, pulse-resistive heating of powders under applied pressures of 200 MPa to 400 MPa. Powders and fabricated disk compacts were characterized by X-ray diffraction, optical and scanning electron microscopy, and resistivity measurements. X-ray diffraction comparisons of starting powder and consolidated material show retention of the single phase 1-2-3 structure and the development of a preferred orientation. In the consolidated pure YBa_2Cu_3Ox, Tc onsets of 87K were accompanied by broad transitions. Iodometric analyses indicated oxygen depletion in the as-consolidated disks. Observed oxygen-content profiles across the sample thickness had values $0.11 < x < 0.35$. The variation in the peak processing temperature within the disk was found to correlate with the oxygen content profile.

36612 (AD-A–204687/8/XAB) **Transformation toughening of ceramics. Final report, 1 September 1985-31 August 1988.** Marshall, D.B. Rockwell International Corp., Thousand Oaks, CA (USA). Science Center. Dec 1988. 101p. (SC–5444.FR). Available from NTIS, PC A06/MF A01.

The results of a three-year study, aimed at understanding factors that dictate microstructural evolution and mechanical properties of transformation toughened ceramics, are summarized. Large crack-growth resistance curves (rather than single-valued toughness) were discovered in toughened zirconia, and these were shown to be responsible for strength-toughness relations, damage tolerance, and other mechanical properties. New insight was gained into mechanisms of controlling grain growth during processing, and a method for forming high strength, fine-grained ZrO_2 fibers was discovered. In the final year's work, reported in detail here, a new tetragonal-to-orthorhomic phase transformation at low temperatures was discovered and shown to have a dramatic effect on mechanical properties. New methods were applied to measure the amount and location of phase transformation within crack tip zones and to quantify crack tip shielding, evaluate stability and reversibility of the martensitic transformation, and to determine the net transformation strain that gives to toughening. Finally, crack growth under cyclic loading was demonstrated to be important in zirconia materials.

36613 (AD-A–205013/6/XAB) **High-temperature superconductivity. Quarterly report No. 1 for period ending FY89.** Eckstein, J.N. Varian Associates, Inc., Palo Alto, CA (USA). Varian Research Center. 9 Jan 1989. 9p. Available from NTIS, PC A02/MF A01.

The goals of this program are to develop the technology of molecular beam epitaxy to growth of high-temperature superconductor material, to optimize the performance of HTSC films with high transition temperatures and critical densities, and to explore the development of electronic devices based on such material. Both fundamental and practical issues are studied which are involved in the heteroepitaxial in-situ growth of copper-containing layered perovskite compounds. This included continued analysis of previously grown films. A significant insight into the MBE growth process was obtained by detailed study of lattice image transmission electron microscopy of one of our earlier as-grown superconducting films of Dy-Ba-Cu-O. In particular, the interplay between kinetic control and the tendency toward thermodynamic equilibrium was evident. This has led to important insights in understanding the process by which layered, superlattice-like structures in these systems can be grown. The aim is to use kinetic control available in MBE from beam shutters and stable sources to atomically layer the superlattice-like structure of extended unit cell HTSC compounds. Active sources of oxygen are employed to ensure the completion of at least the necessary degree of oxidation and the beams of the constituents are turned on and off using mechanical shutters to layer the constituent species and to provide kinetic control of the growth process.

36614 (AERE-R–13232) **Compressive creep in nuclear oxides.** Hough, A. UKAEA Harwell Lab. (UK). Chemistry Div. Aug 1988. 107p. (FRFF/P–88-40;AGT–010101/P7). Available from H.M. Stationery Office, London, price Pound 18.75.

Results are reported of compressive creep tests on uranium dioxide and uranium/plutonium mixed oxides. The deformation rates of the various oxides have been measured as functions of stress, temperature, density, grain size, oxygen/metal ratio. The effect of the addition of other oxides (TiO_2 and ZrO_2) and of simulated fission products has been studied. In general the creep rate for all the compositions studied shows a roughly linear dependence on stress at low stresses, with a diffusion controlled mechanism. Some samples show a threshold stress below which the creep rate is much reduced. At high stresses, where the creep is due to dislocation movement, the creep rate depends on a higher power (4-6) of the stress. The behaviour in these two regions and the changes in the transition stress which mark the boundary between them, are discussed.

36615 (CONF-890426–21) **Evidence for phonon-mediated coupling in superconducting $Ba_{0.6}K_{0.4}BiO_3$.** Hinks, D.G.; Dabrowski, B.; Richards, D.R.; Jorgensen, J.D.; Pei, Shiyou; Zasadzinski, J.F. Argonne National Lab., IL (USA). 1989. 12p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Spring meeting of the Materials Research Society; San Diego, California, USA; 24-28 Apr 1989. Order Number DE89014642/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Superconducting $Ba_{0.6}K_{0.4}BiO_3$, with a T_c of 30K, shows a large ^{18}O isotope effect which indicates that phonons are involved in the pairing mechanism. Infrared reflectivity measurements indicate a value for the superconducting gap consistent with moderate coupling ($2\Delta/kT_c = 3.5 \pm 0.5$). A mediating energy for pairing of about 40 MeV would be required to obtain a T_c of 30K. Strong coupling of electrons by optical phonons (which are present in this material with energies up to 80 MeV) could account for the observed transition temperature. Recent tunneling spectroscopy shows the presence of strongly coupled optical phonons in the 40 to 70 MeV region, indicating that superconductivity in this material may be phonon mediated. 8 refs., 11 figs.

36616 (CONF-890754–1) **Thermal conductivity anisotropy in single crystal $YBa_2Cu_3O_{7-x}$.** Rosencwaig, A.; Opsal, J.; Willenborg, D.L.; Coufal, H. Therma-Wave, Inc., Fremont, CA (USA). 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-88ER80652. From 6. international topical meeting on photoacoustic and photothermal phenomena; Baltimore, Maryland, USA; 31 Jul - 3 aug 1989. Order Number DE89009643/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have used the modulated reflectance thermal wave technique to measure the crystallographic anisotropy in the room temperature thermal conductivity of single crystals of $YBa_2Cu_3O_{7-x}$. 7 refs.

36617 (CONF-8906147–1) **Noncontacting laser diffraction strain extensometer for material properties characterization at high temperatures.** Liu, K.C.; Pih, H. Oak Ridge National Lab., TN (USA). 1989. 6p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From International congress on technology and technology exchange; New York, NY, USA; 28-30 Jun 1989. Order Number DE89013551/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A noncontacting optical system, utilizing the interference fringes produced by the diffraction of laser light passing through a narrow slit, has been developed for measuring static and dynamic strain deformations at elevated temperatures above 1300°C. Basic optical theory, details of instrumentation, system operation, and sample applications are presented. Examples utilizing SiN and Ti alloy composite are given. 4 refs., 11 figs.

36618 (CONF-8906155–1) **The amorphous to gamma transformation in ion implanted Al_2O_3.** Sklad, P.S.; McCallum, J.C.; McHargue, C.J.; White, C.W. Oak Ridge National Lab., TN (USA). 1989. 14p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From Radiation effects in insulators-5: crystalline oxides and ceramics session; Hamilton, Canada; 19-23 Jun 1989. Order Number DE89014797/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Amorphous surface layers, free of implanted impurities, were produced on single crystal α-Al_2O_3 substrates by implantation at −185°C with 2×10^{16} Al/cm^2 at 90 keV and 3×10^{16} O/cm^2 at 55 keV. The response of these amorphous layers to post-implantation annealing in the temperature range from 700°C to 800°C was investigated by in situ transmission electron microscopy (TEM) and conventional TEM of specimens annealed in bulk form. It was found that the amorphous Al_2O_3 transformed to the transitional γ phase along an irregular front. The recrystallized material is columnar with the individual columns or domains irregular in size and shape. The γ-Al_2O_3 is composed of two variants which are twin related and have the following orientation relationship with the substrate: $<110>\gamma$ //$<10\bar{1}0>\alpha$ and $\{111\}\gamma$ //$\{0001\}\alpha$. The temperature-dependence velocity of the amorphous-to-γ transformation front was measured by in situ TEM. Assuming a thermally activated process, the activation energy has been determined from an Arrhenius plot of velocity versus T^{-1}. These results are discussed in terms of possible rate controlling processes of the transformation. 8 refs., 3 figs.

36619 Interfaces and toughening in ceramics. Marshall, D.B. (Rockwell International Science Center, Thousand Oaks, CA (USA)). pp. 9 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Fracture mechanics modelling has recently provided insight into the role of interfaces in toughening of ceramics and ceramic composites by reinforcements that form crack bridging ligaments. Some results of the modelling are summarized and an indentation method is described for measuring interfacial mechanical properties (debond energy, frictional sliding resistance, and residual stresses) at individual fibers in composites with weak interfacial bonding between the fibers and matrix.

36620 Understanding oxide-metal interfaces. Stoneham, A.M. (Theoretical Physics Div., Oxfordshire (England)); Tasker, P.W. pp. 16 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

One of the most important features of the interface between an oxide and a metal is the sharp change in dielectric constant between the two materials. This suggests that the stabilization of charges (lattice ions and defect centers) in the non-metal by the polarization of the metal may contribute strongly to the interfacial adhesion. This effect can be treated in classical electrostatics by the method of images. The authors present the application of this theory to the adhesion of bulk materials and to the properties of thin films and coatings. The predictions of the continuum theory are compared with atomistic calculations of interfaces. Finally, they consider how, in light of this theory, how interfacial adhesion can be influenced and controlled.

36621 Study of long range forces in epitaxy systems: the Ag/Si interface. Shirokoff, J. (Queen's Univ., Kingston, Ontario (Canada)); Hui, K.C.; Erb, U. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The Ag/SiO_x/Si interfacial system is investigated to observe orientation relationships of low energy. For this purpose the orientation distribution of small silver particles on (100) silion substrates was measured after annealing at 700°C. Three orientation relationships resulting in interfaces of low energy were observed, representing cusps in the interfacial energy versus misorientation curve. Two of these preferred orientations are orientations for which close packed and second close packed planes of the silver phase are parallel to the surface, while the third orientation is epitaxial. The epitaxial orientation was found to occur even when an amorphous SiO_x interlayer of about 180 Å separated the Ag particles from the Si substrate. The influence of long range ordering effects are discussed.

36622 Contribution of lattice matching to the interfacial energy between dissimilar materials. Fecht, H.J. (Univ. of Wisconsin, Madison (USA)). pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The interfacial energy of boundaries between dissimilar materials can be described as function of the lattice mismatch, the chemical interaction and the interfacial entropy of the boundaries. Based on experiments involving a sphere-rotation method and undercooling measurements of (solid/liquid) phase mixtures in a droplet dispersion, an attempt is made to separate the influence of the different contributions. The atomic structure of interphase boundaries between noble metals and ionic crystals can be described by the lock-in model: low energy interphase boundaries were found if close packed rows of atoms at the surface of the metal crystal lock into the valleys between close packed rows of atoms at the surface of the ionic crystal. At higher temperatures the relative stability of different interphase boundary structures may change depending on the degree of axial commensuration and the related interfacial entropies. Hence, the contribution of lattice matching to the interfacial energy can decrease or vanish completely in some cases, resulting in a commensurate/incommensurate phase transition (e.g. for Au/Al_2O_3). Furthermore, the droplet undercooling experiments demonstrate that good matching between two crystal lattices (substrate/nucleus) can favor formation of metastable phases due to the lowering of the activation barrier for nucleation during crystallization from a highly undercooled liquid.

36623 High resolution electron microscopy of interfaces in functional materials. Ishida, Y. (Univ. of Tokyo (Japan)); Ichinose, H.; Takahashi, Y. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The authors recent high resolution electron microscopic observation of various interfaces in functional materials such as semiconductor superlattice, superconducting perovskite ceramic, new engineering ceramics, fiber reinforced metal and ceramic-metal joining suggested that the traditional unified view of the interface structure in a number of directions taking into account the chemistry, polytype structures, thickness, bonding heterogenity etc to make the structural theory useful for the future design of the interfaces in modern functional materials.

36624 HVEM and HREM of interfaces in aluminum nitride ceramics. Hagege, S. (Univ. of Tokyo (Japan)); Ishida, Y.; Tanaka, S.

pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Impurities in the wurtzite structure of aluminum nitride (AlN 2H) ceramics are accommodated by a pair of very particular interfaces. An analysis of their structure has been performed using high voltage and high resolution TEM which allowed them to propose a geometrical description of the defect. The main features of the microstructure of this material and its relevant interfaces are also reported.

36625 Diffusion reactions between silicon oxynitride and silicon nitride during HIP-synthesis. Larker, R. (Lulea Univ. of Technology (Sweden)); Loberg, B. pp. 8 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Recent advances in production processes for High Performance Ceramics have made it possible to produce fully dense net shape turbocharger and gas turbine rotors made of silicon nitride. These rotors must usually be attached to a metal shaft by some joining technique. Solid state bonding by diffusion reactions is an attractive route to achieve joints that retain strength at high temperature. Intimate physical contact across the joint during bonding is important for the diffusion process. Hot Isostatic Pressing (HIP) can enhance the contact and thus produce a stronger joint at a lower bonding temperature than other methods. Silicon oxynitride synthesized from a stoichiometric mixture of silicon nitride and silicon oxide by HIP has some interesting properties that might be useful as an intermediate layer in bonding silicon nitride to metals. This work is a part of an assessment to develop solid state bonding methods for the joining of silicon nitride to superalloys by HIP. It presents the first steps in the development, namely the optimization of the synthesis of pure silicon oxynitride during densification by HIP and joining of the oxynitride to silicon nitride during synthesis and densification by HIP. The achievements in these areas and the direction of future work will be discussed.

36626 Hetero- and homo-phase boundaries in ceramic oxides. Carter, C.B. (Cornell Univ., Ithaca, NY (USA)); Colgan, E.G.; McKernan, S.; Simpson, Y.K.; Summerfelt, S.R.; Susnitzky, D.W.; Tietz, L.A. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Interfaces in various ceramic systems which are not based on the rock-salt structure, have been studied and the results are presented together with some models of the interfaces.

36627 Core structure of CSL boundaries in NiO. Merkle, K.L. (Argonne National Lab., IL (USA)); Reddy, J.F.; Wiley, C.L.; Smith, D.J. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). DOE Contract W-31-109-ENG-38. (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Atomic resolution electron microscopy is used to study (001) CSL tilt boundaries in NiO. Asymmetric as well as symmetric grain-boundary plane orientations are found in bicrystals grown by the Verneuil technique. The Σ=5, (310) grain boundary is observed to occur in two distinct forms, both of which differ from previously proposed theoretical models. The Σ=13, (510) boundary, in addition to also showing a multiplicity of structures, is not planar on an atomic scale, but includes displacements of structural units normal to the average grain-boundary plane. It is suggested that the reduced atomic density at high-purity ceramic-oxide grain boundaries is not only due to lattice expansion, but is in part due to a high concentration of Schottky pairs in the grain boundary.

36628 Structural analysis and properties of grain boundaries in hexagonal carbides. Vicens, J. (Universite de Caen (France)); Laurent-Pinson, E.; Chermant, J.L.; Nouet, G. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Grain boundaries in tungsten carbide crystals (hexagonal structure c/a = 0.976) show many coincidence orientations. The most frequent orientation has a coincidence index Σ=2. H.R.E.M. images of such grain boundaries have been realized. These grain boundaries show a defect structure, only due to the mismatch of the a and c parameters. These defects consist of dissociated $1/6(1120)_1$ or $1/2\ (0001)_2$ dislocations regularly spaced. An atomic step is associated with each dislocation. This particular grain boundary can be described as a Σ=2 (c/a = 1) grain boundary with a periodic structure of dislocations or as a Σ=39 (c/a = 0.975) grain boundary with a 1°5 deviation to the exact coincidence orientation.

36629 TEM study of ZrO_2/Al interface. Tremouilles, G. (ETCA, Arcueil (France)); Portier, R. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Yttria partially stabilized zirconia is coupled to monocrystalline pure aluminum by thermal-compressive process. A good adhesion is obtained, and alumina microcrystals are observed at the interface. The oxygen diffusion from zirconia allows alumina's growth. Preferential orientation relationships exist at this interface.

36630 Phase transformation in boron doped SiC: HREM study of a twin interface. Lancin, M. (CNRS, Meudon (France)); Thibault-Desseaux, J. pp. 8 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

In the materials studied, the phase transformation $\beta \rightarrow \alpha$ involves the formation of feathers which can be described as penetration twins. In this investigation the structure of a twin interface is studied by high resolution electron microscopy (HREM). The twin studied has a 15R structure and a high angle twin boundary. An attempt is made to explain the formation of such a twin.

36631 Equilibrium crystal shapes and surface phase diagrams at surfaces in ceramics. Handwerker, C.A. (National Bureau of Standards, Gaithersburg, MD (USA)); Vaudin, M.D.; Blendell, J.E. pp. 8 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The equilibrium shape of a crystal is the shape which minimizes the total surface free energy of the crystal and may contain any or all of the following: facets, sharp edges, smoothly curved surfaces, and corners. The relationship between the surface free energy per unit area, γ, and the equilibrium crystal shape is seen straightforwardly from the Wulff plot, the polar plot of γ as a function of orientation of the normal vectors, n. Cabrera, Cahn, and Rottman and Wortis have described the boundaries between surfaces on the equilibrium crystal (for example, between adjacent facet planes) as surface phase transitions. If γ(n) changes with temperature, pressure, or chemical potentials of the components, the equilibrium shape of the crystal may change. This change in equilibrium shape can be represented by a surface phase diagram with axes of surface orientation, in terms of angle from an arbitrary orientation, and temperature, pressure, or chemical composition. The surface phase transitions of MgO have been determined as a function of NiO solute concentration and surface phase diagrams have been constructed.

36632 Influence of doping elements on the grain boundary characteristics in alumina. Lartigue, S. (Universite Paris-Sud, Orsay (France)); Priester, L. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793--: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The distribution and characteristics of grain boundaries have been determined in pure undoped and Mg-doped aluminas. Mg-doped alumina presents a high proportion of special coincidence boundaries while in pure undoped alumina most of boundaries are general but present densely packed planes. The grain boundary distributions are analyzed in relation with the microstructures of the two materials.

36633 Grain boundary diffusion of Co and Ni in bicrystalline and polycrystalline NiO. Barbier, F. (Universite Paris-Sud, Orsay (France)); Dechamps, M. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Grain boundary diffusion of Co and Ni has been studied in (001) and (011) symmetrical tilt NiO bicrystals. No preferential intergranular diffusion has been detected. It is thought that cation diffusion along grain boundaries is less than 10^3D, where D is the lattice diffusion coefficient, and not of the order of 10^5D as published. Moreover, it is unlikely that impurities are entirely responsible for the discrepancies.

36634 Interfacial characteristics of glass-ceramic matrix/SiC fiber composites. Brennan, J.J. (United Technologies Research Center, Hartford, CT (USA)). pp. 20 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The fiber/matrix interfacial region between lithium aluminosilicate (LAS) glass-ceramic matrices and a variety of SiC and/or Si-C-N-O fibers and whiskers was examined, primarily through the use of the scanning transmission electron microscope (STEM) and the scanning Auger multiprobe (SAM). It was found that the interfacial chemistry varied widely, depending upon the particular fiber or whisker utilized, and that the chemistry of the interface determined to a large degree the resultant mechanical properties of the composite. In general, those composites exhibiting a weakly bonded fiber/matrix interface tended to be strong and tough, while those exhibiting a strongly bonded interface were weak and brittle.

36635 (INIS-BR–1535) **Advanced ceramics in Brazil: actual stage and perspectives.** Zanotto, E.D. Ministerio de Ciencia e Tecnologia, Brasilia, DF (Brazil). Nov 1986. 61p. (In Portuguese). Order Number DE89619612/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The development of advanced ceramics in Brazil, the perspectives of the world and Brazilian markets, the raw materials, the equipments for industry and research, the human resources, and the disposable technology, are presented. The researches on advanced ceramics in Brazil initiated in the sixty decade, with the nuclear fuel development and production projets. (M.C.K.).

36636 (INIS-SU–89, pp. 152) **Investigations into physicochemical properties of lithium metaaluminate ceramics.** Krutyakov, A.N. (AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii); Reunova, L.N.; Saunin, E.I.; Gromov, V.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CERAMICS/electric conductivity; CERAMICS/phase studies; LITHIUM COMPOUNDS/ceramics; ALUMINATES; CERAMICS; MASS TRANSFER; PERMITTIVITY; SENSITIVITY; SINTERING; THERMAL DEGRADATION; THERMAL EXPANSION

36637 (INIS-SU–89, pp. 153) **Synthesis and properties of $LiAlO_2$ lithium aluminate monocrystals.** Krutyakov, A.N. (AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii); Saunin, E.I.; Rozno, A.G.; Lukhin, A.S.; Gromov, V.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

LITHIUM COMPOUNDS/crystal growth; LITHIUM COMPOUNDS/ferroelectric materials; ALUMINATES; DENSITY; LATTICE PARAMETERS; MONOCRYSTALS

36638 (LA–11577-MS) **SiC-$MoSi_2$ composites.** Carter, D.H.; Petrovic, J.J.; Honnell, R.E.; Gibbs, W.S. Los Alamos National Lab., NM (USA). Jun 1989. 11p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-7405-ENG-36. Order Number DE89013656/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Previous studies have shown that SiC whisker-reinforced $MoSi_2$ is an excellent candidate material for structural use at elevated temperatures. The yield strength at 1400°C was doubled with the addition of Los Alamos VLS SiC whiskers, and increased by a factor of five with the addition of VS SiC whiskers, despite a non-optimal distribution of the reinforcement resulting from dry blending fabrication procedures. A more optimal wet processing technique, providing a much more uniform distribution of the whisker reinforcement will be discussed. Activities directed at alloying $MoSi_2$ with other silicides to improve the mechanical properties of the matrix material will also be described. 6 refs., 5 figs., 1 tab.

36639 (LA-UR–89-1777) **Barium potassium bismuth oxide: Synthesis and physical properties.** Ott, K.C.; Hundley, M.F.; Kwei, G.H.; Maley, M.P.; McHenry, M.E.; Peterson, E.J.; Thompson, J.D.; Willis, J.O. Los Alamos National Lab., NM (USA). 1989. 12p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890426–23: Spring meeting of the Materials Research Society, San Diego, California, USA, 24-28 Apr 1989). Order Number DE89013458/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A series of compounds $Ba_{1-x}K_xBiO_3$ have been prepared and characterized over the range of compositions ranging from x = 0.3 to 0.5. A neutron powder diffraction analysis has been carried out for the composition x = 0.4 at room temperature and at 10 K. Examination of the superconducting properties as a function of x indicates superconductivity occurs over a narrow range of compositions close to x = 0.4, with T_c of 29 K. Specific heat measurements indicate conventional electron-phonon interactions may play a role in promoting superconductivity in $Ba_{.6}K_{.4}BiO_3$. Magnetization loops and examination of the time dependent magnetization indicate that $Ba_{.6}K_{.4}BiO_3$ has a low value of J_c due to very weak pinning. 18 refs., 6 figs.

36640 (LA-UR–89-2059) **Nuclear relaxation rates at copper and oxygen sites in $YBa_2Cu_3O_7$.** Hammel, P.C.; Takigawa, M.; Heffner, R.H.; Fisk, Z.; Ott, K.C. Los Alamos National Lab., NM (USA). 1989. 3p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890718–5: International conference on materials and mechanisms of superconductivity - high-temperature superconductors, Stanford, California, USA, 23-28 Jul 1989). Order Number DE89014308/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We report NMR measurements of the nuclear relaxation rate at all copper and oxygen sites in magnetically aligned powder samples of $YBa_2Cu_3O_7$. There is no peak in the oxygen relaxation rate below T_c at any oxygen site supporting the possibility that d-wave pairs are formed in the superconducting state. Comparison of the oxygen and copper rates in the planes reveals a characteristic temperature greater than T_c. 6 refs., 2 figs.

36641 (LA-UR–89-2141) **^{17}O NMR study of $YBa_2Cu_3O_{7-\delta}$.** Takigawa, M.; Hammel, P.C.; Heffner, R.H.; Fisk, Z.; Ott, K.C.; Thompson, J.D. Los Alamos National Lab., NM (USA). 1989. 4p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890718–3: International conference on materials and mechanisms of superconductivity - high-temperature superconductors, Stanford, California, USA, 23-28 Jul 1989). Order Number DE89014292/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

We present our ^{17}O NMR experimental results in a magnetically aligned powder sample of $YBa_2Cu_3O_{7-\delta}$ (T_c = 93 K). The sign of the anisotropic Knight Shift shows that the spin density resides mainly on the p_σ orbitals at the planar O(2,3) and bridging O(4)

sites. About 30 % of the total spin susceptibility is attributed to the oxygen $2p_\sigma$ states. The Knight shift at the O(2,3) sites decreases more rapidly than that at the chain O(1) sites, indicating a larger gap in the planes. The nuclear relaxation rate at the O(2,3) sites shows linear-T (Korringa) behavior above T_c, in contrast to the much temperature dependence at the planar Cu(2) sites. However, these two rates show identical temperature dependence below about 110 K, indicating that an important change in the spin dynamics takes place above T_c. 13 refs., 3 figs.

36642 (LA-UR–89-2142) **Anomalous temperature dependence of Cu NMR line width and magnetization in $YBa_2Cu_3O_{7-\delta}$.** Takigawa, Masashi; Hammel, C.P.; Heffner, R.H.; Fisk, Z.; Thompson, J.D.; Maley, M. Los Alamos National Lab., NM (USA). 1989. 2p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890718–4: International conference on materials and mechanisms of superconductivity - high-temperature superconductors, Stanford, California, USA, 23-28 Jul 1989). Order Number DE89014291/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

We report an anomalous temperature dependence of the magnetization and the NMR line width at the planar Cu(2) and oxygen sites in the mixed state of aligned $YBa_2Cu_3O_{7-\delta}$ powder at relatively high field ($\geq$30 kOe), where hysteresis of the magnetization due to flux pinning is not important. Both the magnetization and the NMR line width at all sites show a steep increase at low temperature. We found a much larger line width at Cu(2) sites than at oxygen sites when the magnetic field is applied perpendicular to the c-axis, indicating a very microscopic local field modulation. 4 refs., 2 figs.

36643 (NRCC/IMR–28160) **Plasma spraying of WO/sub3/. Structure characterization of the coating.** Ladouceur, M; Dodelet, J.P.; Parent, L.; Dallaire, S. National Research Council of Canada, Boucherville, PQ (Canada). Industrial Materials Research Inst. [1989]. 25p. (MICROLOG–89-00555). Available from Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

WO_3 is a semiconducting oxide absorbing in the visible part of the solar spectrum. Since it produces stable photoanodes in aqueous solution, this material has been contemplated as a possible candidate for assisted photoelectrolysis of water. As part of a study of the relation between the photoelectrochemical and photocatalytic properties of WO_3 coatings obtained by plasma spray, WO_3 coatings with a thickness of 40$\pm$ 20μm —mm have been obtained on titanium substrates. Scanning electron microscopy and x-ray diffraction have been used to characterize the WO_3 powders before and after injection in the plasma. The same techniques have also been used to characterize the coatings obtained with various projection conditions. The substoichiometry of plasma sprayed tungsten oxide has been determined by thermogravimetry. It is possible to obtain $WO_{2.99}$ (yellow) or $WO_{2.97}$ (dark blue) directly by projection. A thermal treatment allows the oxidation of $WO_{2.97}$ to the yellow form. Its seems that both colored substoichiometric forms of WO sub 3/ display the same crystalline structure but the yellow form shows the most defined x-ray spectrum. Even if the yellow coating diffractograms and the literature x-ray spectrum for orthorhombic WO_3 are similar, it is not possible to ascertain if plasma sprayed coatings are characterized either by the orthorhombic structure alone or by a mixture of the orthorhombic and monoclinic forms. 30 refs., 9 figs.

36644 (NRCC/IMR–28911) **Localized electrons in tetragonal $YBa_2Cu_{2.93}O_{6.38}$.** Inoue, Z.; Sasaki, S.; Dallaire, S.; Iyi, N.; Takekawa, S. National Research Council of Canada, Boucherville, PQ (Canada). Industrial Materials Research Inst. [1989]. 10p. (MICROLOG–89-00548). Available from Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The structure refinement of tetragonal $YBa_2Cu_{2.93}O_{6.38}$ has been carried out with the final R-value of 0.019 obtained by the X-ray single crystal diffraction method. Difference Fourier maps reveal the existence of localized electrons around Cu and Ba atoms in the unit cell. The crystal structure is closely related to the perovskite type. 20 refs., 3 figs., 4 tabs.

36645 (NRCC/IMR–29441) **Microstructural investigation of $RBa_2Cu_3O_{7-\delta}$ (R=Y, Gd, Nd).** Parent, L; Moreau, C.; Noel, D.; Dallaire, S.; Champagne, B. National Research Council of Canada, Boucherville, PQ (Canada). Industrial Materials Research Inst. [1989]. 11p. (MICROLOG–89-00589). Available from Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

$RBa_2Cu_3O_{7-\delta}$ perovskites, where R is Y, Gd and Nd, were synthetized using the same experimental conditions. The resistivity curves of the three compounds were similar but their microstructures were different. Secondary phases (CuO, $BaCuO_2$) were formed in the compounds containing Y and Gd while no such phases were detected in the Nd perovskite material. According to these preliminary results, the perovskite containing Nd is readily synthesized since the amount of secondary phases is much lower in that case. 7 refs., 4 figs., 1 tab.

36646 (NRCC/IMR–29447) **Solid-state interaction between nickel and $YBa_2Cu_3O_x$.** Champagne, B.; Parent, L.; Moreau, C. National Research Council of Canada, Boucherville, PQ (Canada). Industrial Materials Research Inst. [1989]. 13p. (MICROLOG–89-00580). Available from Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

As part of a search for suitable metals for use in composite cables made up of high-temperature superconductors in a metallic matrix, the solid-state reaction between nickel and $YBa_2Cu_3O_x$ was studied. Green compacts of $YBa_2Cu_3O_x$ were hot isostatically pressed (HIPed) in nickel. The microstructure, density and nature of phases present in HIPed parts were characterized. Resistivity measurements indicated that HIPed parts are not superconducting owing to the loss of oxygen and required an annealing step in oxygen for restoring superconductivity. The diffusion of nickel into $YBa_2Cu_3O_x$ as well as the diffusion of Ba, Cu and Y into nickel was very limited. However, a thin interaction zone consisting of a nickel-rich oxide compound was formed at the Ni-$YBa_2Cu_3O_x$ interface. The presence of such an interaction zone could have a detrimental effect on the thermal stabilization of Ni-$YBa_2Cu_3O_x$ composite wires. 7 refs., 6 figs., 1 tab.

36647 (SAND–88-2865C) **Annealing and strain effects on Tl-Ba-Ca-Cu-O crystals and ceramics.** Venturini, E.L.; Morosin, B.; Ginley, D.S.; Kwak, J.F.; Schirber, J.E.; Baughman, R.J.; Graham, R.A. Sandia National Labs., Albuquerque, NM (USA). 1989. 10p. Sponsored by DOE Energy Research. DOE Contract AC04-76DP00789. (CONF-890426–22: Spring meeting of the Materials Research Society, San Diego, California, USA, 24-28 Apr 1989). Order Number DE89014628/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Superconducting transition temperatures (T_c's) in the Tl–Ba–Ca–Cu–O system are shown to be a function of processing for both single crystals and bulk ceramics. Crystals with the identical structural phase and nominal composition but slightly different lattice constants can have significant differences in T_c. We report the effects of high temperature annealing in vacuum or flowing oxygen on T_c for single crystal plates of two common phases with nominal stoichiometries $Tl_2Ba_2Ca_1Cu_2O_8$ and $Tl_2Ba_2Ca_2Cu_3O_{10}$. Contradictory results on nominally similar crystals suggest that strain, Tl content and Tl/Ca site disorder are as important as the oxygen stoichiometry in determining T_c. This interpretation is supported by complementary annealing studies in bulk ceramic, including a powder where T_c increased by 5 K following high-pressure shock loading which introduced substantial residual strain. 25 refs., 6 figs.

36648 Investigation of the lanthanide sesquioxides as high temperature transformation toughening agents. Jero, P.D. 239p. Univ. of Illinois, Urbana, IL (1988).

One of the recent bright spots in the field of engineered materials was the developed of transformation toughened ZrO_2 ceramics. This one discovery led to a whole new class of strong, tough engineered ceramics. Recently, Kriven reviewed phase transformations in a number of inorganic materials which show potential as transformation toughening agents. Amongst those materials are the

lanthanide sesquioxides. Known for their thermal stability, several of the lanthanide sesquioxides exhibit, on cooling, the requisite rapid phase transformation from a high temperature monoclinic (B) phase to a less dense low temperature cubic (C) phase. The volume expansion is about 8 to 10%, but the transformation mechanism is not known. The transformation is in several ways similar to the martensitic tetragonal to monoclinic transformation in ZrO_2. The aim of this work was to investigate the C$\Longleftrightarrow$B transformation in the lanthanide sesquioxides and evaluate their potential as transformation toughening agents, particularly at high temperature. A detailed description of the lanthanide sesquioxides serves (1) to introduce the reader to a subject which may well be new to him or her and (2) to indicate the complexity of the materials being examined. The literature is voluminous and yet relatively few researchers have studied these materials. Two groups, one in France, the other in the USSR, account for much of the basic research done so far. This results, undoubtedly, from the fact that ultra high temperatures are often required in the study of these materials. Both of the above groups have ultra high temperature solar furnaces with x-ray diffraction and thermal analysis attachments. 218 references.

36649 X-ray absorption spectroscopy investigations of high Tc superconductors. Greeger, R.B. (The Boeing Co., Seattle, WA (US)); Marques, E.C.; Lytle, F.W.; Larson, E.M.; Peterson, D.; Panson, A.J.; Stohr, J. v.v of 1988 Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy (abstracts). Pittsburgh Conference, Pittsburgh, PA (1988). (CONF-880204–: 39. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, New Orleans, LA, USA, 22-26 Feb 1988).

Technical Paper NO. 010.

The X-ray and neutron diffraction techniques commonly used for investigating the structure of materials have limitations in sensitivity when the scattering factors of the different elements are similar. In contrast, x-ray absorption spectroscopy has an element specific advantage in that the x-ray energy can be tuned to an absorption edge of each type of atom in the material. The structure probe then becomes the quantum interference of the ejected photoelectrons as they scatter from atoms surrounding the absorbing species. The resulting x-ray absorption near edge structure (XANES) and extended x-ray absorption fine structure (EXAFS) are sensitive to various structural and chemical parameters including bond distance, coordination number, disorder and valence. The absorption spectra of well-characterized samples of $YBa_2Cu_3O_7$ and $La_{1.8}Sr_{0.2}CuO_4$ were measured at the Stanford Synchrotron Radiation Laboratory. The results showed that in addition to the normal lattice sites which are known from x-ray and neutron diffraction refinements, a significant anti-site disorder exists between Cu and Y/La sites.

36650 Composition and structure of the passive oxide film on iron as observed by second harmonic generation. Schauer, M.W. (Argonne National Lab., 9700 South Cass Avenue, Argonne, IL (US)); Frye, J.M.; Biwer, B.M.; Pellin, M.J.; Gruen, D.M. v.v of Proceedings of the Electrochemical Society fall meeting. Volume 88-2 (extended abstracts). The Electrochemical Society, Pennington, NJ (1988). (CONF-881061–: Electrochemical Society fall meeting, Chicago, Illinois, USA, 9-14 Oct 1988).

The technique of Second Harmonic Generation (SHG) as a surface analytical tool has progressed to the point where scientific information, not easily observed by other means, can be obtained for systems such as metal surfaces undergoing electrochemical reactions. Despite extensive study, the compositional and structural details of the passive oxide layer on iron are not well understood. SHG is extremely sensitive to compositional changes as an iron electrode is cycled. Resonance enhancement of the SHG signal can be correlated with the expected electronic spectroscopy of the various iron oxide species believed to be present. In addition, by using an incident frequency for which no resonance enhancement is observed, changes in the SHG signal can be interpreted as due to charging. This provides further information about the electrical properties of the film. By comparing the SHG results for the iron electrochemical system with previous models of the iron passive layer, new understanding about the composition of this system has been realized. SHG intensity as a function of potential is plotted for cycling an Fe electrode. The top curve represents the current and shows the well-known waves associated with oxidation and reduction of iron. The second curve shows the SHG intensity using 1.06 μ (detecting 532 nm) light as the fundamental. The authors believe that surface charging contributes significantly to the SHG intensity in the 1.06 μ SHG experiment. On the other hand, resonance enhancement is largely responsible for the intensity in the 532 nm SHG experiment. The lower curve displays the SHG intensity using 532 nm light as the fundamental (detecting 266 nm).

36651 In situ high-temperature cross-sectional TEM specimen preparation. Fiore, E.M. (Martin Marietta Labs., 1450 S. Rolling Rd., Baltimore, MD (US)); Herring, R.A. v.v of Specimen preparation for transmission electron microscopy of materials. Bravman, J.C.; Anderson, R.M.; McDonald, M.L. Materials Research Society, Pittsburgh, PA (1988). (CONF-871297–: Symposium on specimen preparation for transmission electron microscopy of materials, Boston, Massachusetts, USA, 3 Dec 1987).

The authors describe a technique for preparing transmission electron microscope (TEM) cross-sectional specimens for observation during in situ annealing to high temperatures. The process utilizes a ceramic adhesive that is stable to a temperature of 1650^{0}C. The technique, which was successfully used to observe the recrystallization of amorphized silicon, is being applied to high-energy ion-implanted silicon in an attempt to better understand the amorphous-to-crystalline phase transformation and detect formation mechanisms resulting from thermal processing.

36652 Phase relations in quaternary copper oxide electrodes. Ahn, B.T. (IBM Almaden Research Center, San Jose, CA (US)); Gur, T.M.; Huggins, R.A. v.v of Electro-ceramics and solid-state ionics. Tuller, H.L.; Smyth, D.M. The Electrochemical Society, Pennington, NJ (1987). (CONF-8710306–: Symposium on electro ceramics and solid state ionics, Honolulu, HI, USA, 18-23 Oct 1987).

Multicomponent oxides have been used as oxygen electrode materials in high temperature electrochemical cells, and have also been explored for use as cathodes in alkali metal batteries at lower temperatures. The practical usefulness of such materials depends to a large extent on their thermodynamic stability over the range of oxygen activities imposed during synthesis and under operating conditions. This paper reports the use of a solid state ionic technique to study the phase relations and to determine the stability limits at 850^{0}C for $Y_1Ba_2Cu_3O_{7-x}$, a material which may be useful either as an oxygen electrode material in high temperature electrochemical cells, or in low temperature high energy batteries. This material has also recently attracted unprecedented attention as a high temperature superconductor.

36653 Compacted 1-2-3 ceramic powders treated as superconducting composites. Collings, E.W. (0747000); Markworth, A.J.; Marken, K.R. Jr. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA)*, 25(2): 2175-2179 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

Magnetization studies of closely spaced fine-filamentary Cu/NbTi composites have shown that at very low applied field strengths proximity-effect coupling (across the Cu matrix) between the filaments causes the assembly to exclude flux in the manner of a solid block of superconductor of the same outside diameter as the filamentary bundle. Then at somewhat higher applied field strengths (but still with $H < H_{c1}$) the conductor behaves as a cluster of independent filaments. Next, in this regime and provided the filaments are sufficiently fine, field penetration reduces the volume of excluded flux significantly below the geometrically calculated value. Since the field-penetration depth increases with temperature according to $1/\sqrt{(1-t^4)}$ where $t=T/T_c$, the effect becomes more and more pronounced as T approaches T_c. Comparable proximity- and field-penetration effects are seen in high-T_c ceramic-powder compacts. Finally, it is suggested that granularity of some kind, with its associated field-penetration effect, could well be responsible for most the departures from almost complete flux exclusion that have been observed in almost fully single-phase ceramic samples – material which would otherwise be expected to exhibit a sharp magnetic transition at T_c.

36654 Properties of the new high T_c materials. Kresin, V.Z. (9513034); Deutscher, G.; Wolf, S.A. *IEEE (Institute of Electrical*

and Electronics Engineers) Transactions on Magnetics (USA), 25(2): 2333-2336 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

A key feature of the high T_c oxides is a very small value of the Fermi energy. This feature leads to peculiar thermodynamic and transport properties in the normal and superconductive state.

3606 Other Materials

Refer also to citation(s) 35628, 35789, 35794, 35957, 35961, 36091, 36172, 36223, 36369, 36495, 36517, 36582, 36589, 36590, 36599, 36600, 36617, 36622, 36623, 36625, 36634, 36650, 36651, 36724, 36726, 36884, 36971, 36993, 36994, 37019, 37128, 37469

36655 (AD-A–204736/3/XAB) **Methods for studying effects of high-energy irradiation on the mechanical and electric properties of polymers.** Hedvig, P. Hacettepe Univ., Ankara (Turkey). 1987. 95p. Available from NTIS, PC A05/MF A01.

High-energy electron, x-ray or gamma irradiation is known to result in degradation and/or crosslinking of polymers. Crosslinking usually dominates when the polymer is irradiated in the absence of oxygen, while degradation is overwhelming when oxygen is present. The aim of this paper is to discuss how to measure the effects of high-energy irradiation on the main mechanical and electric properties of polymers.

36656 (AD-A–204822/1/XAB) **Scanning tunneling microscopy of an ion-bombarded PbS(001) surface.** Wilson, I.H.; Zheng, N.J.; Knipping, U.; Tsong, I.S. Arizona State Univ., Tempe, AZ (USA). Dept. of Physics and Astronomy. 21 Nov 1988. 4p. Available from NTIS, PC A02/MF A01.

Pub. in Applied Physics Letter, Vol. 53, No. 21, 2039-2041(21 Nov 1988).

Freshly cleaved (001) surfaces of single-crystalline PbS were bombarded by 8-keV Kr(+) ions at a dose of 3×10^{12}/sq. cm. Atomically resolved scanning tunneling microscopy (STM) images were taken showing damaged areas due to individual ion impacts. Analysis of an STM image shows a shallow impact crater, a stacking fault, displacement of Pb(2+) and S(2-) ions from their regular surface sites, and migration of interstitials to the surface.

36657 (AD-A–204881/7/XAB) **Proton backscattering in bulk silicon at large angles of incidence. Final report.** Tallon, R.W.; Hoffland, A.H.; Kemp, W.T.; Locker, T.R. Air Force Weapons Lab., Kirtland AFB, NM (USA). Dec 1988. 26p. (AFWL-TR–88-92). Available from NTIS, PC A03/MF A01.

This report describes proton-backscatter studies performed at the Tandem Van de Graaff Accelerator Facility. The objective was to determine if backscattering protons were sufficient to alter the radiation-induced proton damage in silicon electronics when high-energy protons (6 MeV and below) bombarded bulk silicon at large angles of incidence (>65 deg). The overall results showed that when the angles of incidence of bombarding protons (on bulk silicon) approached 80 deg, and their energies were lowered to about 100 KeV the number of backscattering protons approached 12% of the bombarding number. At this point (and at lower energies), the effect of the backscattering protons would become significant and they would have to be taken into account when determining the radiation induced proton damage in silicon electronics. The number of backscattering protons, their energies, and their angles of reflection (for silicon and other solids) can accurately be determined from a computer program called TRIM (Transport of Ions in Matter).

36658 (AD-A–204914/6/XAB) **Far- and mid-infrared properties of metal-insulator composite materials. Annual letter report, 1 January-31 December 1988.** Devaty, R.P. Pittsburgh Univ., PA (USA). Dept. of Physics and Astronomy. 1988. 40p. Available from NTIS, PC A03/MF A01.

The infrared properties of thin Pt/Al_2O_3 granular metal-insulator composite films (cermets) were investigated using Fourier transform spectroscopy. The films were grown by dual-electron-beam evaporation onto polished single-crystal sapphire substrates. The metallic volume fraction, which was controlled by the deposition conditions, ranged from 23% to 100% in the set of samples. The percolation threshold estimate from the temperature dependence of the dc resistance is greater than 50%, which implies that the Pt particles are highly correlated. The percolation threshold for a random metal-insulator mixture is less than 20%. The transmission and relative reflection of the films were measured at room temperature using a Nicolet 740 Fourier transform infrared spectrometer (FTIR), which arrived at the beginning of the year. The mid- and near-infrared regions (400-15250 cm-1) were covered using three combinations of sources, beamsplitters, and detectors. The reflection standard was a 100% Pt film from the sample set.

36659 (BNL–42655) **Cognition and order in Langmuir-Blodgett films of a 3-hexadecyl pyrrole and ferrocene-derivatized pyrrole mixed monolayer system.** Samuelson, L.; Rahman, A.K.M.; Puglia, G.P.; Clough, S.; Tripathy, S.; Inagaki, T.; Yang, X.Q.; Skotheim, T.A.; Okamoto, Y. Brookhaven National Lab., Upton, NY (USA). 1989. 10p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8903128–1: International conference on intelligent materials, Tsukuba, Japan, Mar 1989). Order Number DE89012974/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Novel, self-assembled materials have been designed and produced from first principle to possess unique structural hierarchy and electronic and optical properties. The Langmuir-Blodgett technique was used to study the molecular organization of a mixed 3-hexadecyl pyrrole (3HDP) and ferrocene-derivatized pyrrole (Fc-Py) surfactant system. The pyrrole moiety was chosen for its' well established electronic and optical properties when polymerized, while ferrocene, it is theorized, if properly oriented into a Langmuir-Blodgett monolayer film may show a layered array of transition metals which would be extremely valuable as a model for two-dimensional magnets. The ferrocene group may also provide the possibility of charge coupling between neutral ferrocene and oxidized ferricenium which could be controlled electrochemically or photochemically. It has been determined that stable monolayer films of the mixed system could be formed at the air-water interface. The growth and assembly process led to polypyrrole 2-D lattices with heretofore unsurpassed order. In fact, the process of template polymerization leads to a new crystal phase for the polypyrrole component of the thin film structure. Various monolayer and multilayer films were prepared on platinum coated substrates for surface spectroscopic characterization using synchrotron radiation. Near Edge X-Ray Absorption Fine Structure studies revealed that highly ordered multilayer structures are being formed. 8 refs., 4 figs., 1 tab.

36660 (CCL–87081) **Development of air-entrained, high-strength concrete. Normal weight concrete.** Bedard, C.; CAIL, K. Canada Cement Lafarge Ltd., Woodstock, ON (Canada). 1987. 23p. (MICROLOG–88-05971). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The potential construction of offshore concrete platforms off the coast of Newfoundland has created a demand for high performance concrete made from local materials. This paper reports the developments of air-entrained, high-strength concrete incorporating mineral admixtures and a high-range water reducer. In some of the mixtures, steel or polypropylene fibers were incorporated to improve the impact and abrasion resistance of concrete. 14 concrete mixtures comprising 45 batches were made in this investigation, and a total of 686 cylindrical, prism, and slab specimens were tested. It is concluded that air-entrained, high-strength concrete with a strength >80 megapascals (MPa) at 91 days can be produced using materials from the Atlantic provinces. The highest strength achieved was 85 MPa for a mixture incorporating 15% Class F fly ash, 6% condensed silica fume, and a high-range water reducer. The concrete so developed has excellent frost resistance and very low permeability. 7 refs., 12 tabs.

36661 (CCL–87082) **Development of air-entrained, high-strength concrete. Lightweight concrete.** Bedard, C.; Cail, K. Canada Cement Lafarge Ltd., Woodstock, ON (Canada). 1987. 14p. (MICROLOG–88-05971). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Tests were carried out on the production of high-strength (>50 megapascals) lightweight concrete of the type suitable for use in offshore platforms. The concrete was batched in a commercial ready-mix concrete plant, and used an air-entraining admixture, superplasticizer, and silica fume as additives. The aggregate was obtained from a local source. From the test results, it is concluded that lightweight concretes with compressive strengths approaching 70 megapascals at 91 days and densities of the orders of 2000 kg// m^3 can be produced commercially. This type of concrete has a flexural strength of ca 7 megapascals, is air-entrained, and has satisfactory resistance to repeated cycles of freezing and thawing. 1 ref., 5 tabs.

36662 (CONF-890435–4) **Structural and thermodynamic evidence for the survival of Zintl ions through the melting process: The alkali-lead alloys.** Saboungi, M.L.; Johnson, G.K.; Price, D.L.; Reijers, H.T.J. Argonne National Lab., IL (USA). 1989. 18p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From 6. international conference on high temperatures: chemistry of inorganic materials; Gaithersburg, Maryland, USA; 3-7 Apr 1989. Order Number DE89013646/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Recent heat capacity and neutron diffraction measurements carried out on liquid equiatomic alkali-lead alloys give unambiguous evidence for the survival of Zintl compounds in the liquid. The presence of polyvalent anionic species, Pb_4^{4-}, is responsible for the anomalous temperature dependence of the heat capacity. Models based on the presence of A_4Pb_4 structural units in the liquid are used to interpret the changes in the width and position of the FSDP as the alkali metal, A, changes from Na to Cs. 18 refs., 7 figs.

36663 (CONF-890627–2) **The texture variation in extruded graphite.** Kennedy, C.R.; Hobson, D.O.; Woodruff, E.M. Oak Ridge National Lab., TN (USA); Westinghouse Hanford Co., Richland, WA (USA). 1989. 2p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400;AC06-76RL01857. From 19. biennial conference on carbon; University Park, Pennsylvania, USA; 25-30 Jun 1989. Order Number DE89014086/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The effect of the extrusion process in creating a significant variation in the preferred orientation has been demonstrated. The variation in physical properties, primarily dependent on crystallite orientation (CTE, electrical resistivity, and elastic constants), is shown to be in good agreement with calculated values. TSX graphite is also shown to have a preferred orientation in flaw structure as determined by sonic attenuation measurements. The expected variability in strength, using a fracture mechanics approach, is described. The effect of this variability also has been shown to have a strong effect on the dimensional change in grade TSX under nuclear irradiation. 5 refs., 7 figs.

36664 (CONF-890771–1) **Full-pattern refinement of crystalline polymer fibers based on diffractometer measurements.** Busing, W.R. Oak Ridge National Lab., TN (USA). 1989. 9p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From American Crystallographic Association annual meeting; Seattle, Washington, USA; 23-29 Jul 1989. Order Number DE89011230/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

POLYMERS/diffraction; CRYSTALS; POLYMERS; DIFFRACTION; FIBERS; LEAST SQUARE FIT; F CODES; CRYSTAL LATTICES; POLYETHYLENES

36665 (CONF-8509443–1) **Techniques for producing monodispersed biocatalyst beads for use in columnar bioreactors.** Scott, C.D. Oak Ridge National Lab., TN (USA). 1985. 11p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 8. enzyme engineering; Helsingor, Denmark; 22-27 Sep 1985. Order Number DE89014194/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The use of columnar bioreactors such as fixed or fluidized beds requires that the biocatalyst (e.g., microorganism) be immobilized into or onto solid support materials that will not be swept out of the bioreactor at the high flow rates frequently used in these systems. At the same time, the pathlength to and through the biocatalyst must be relatively short to reduce the effects of mass transport of substrates and products; thus, small particles or thin films of the biocatalyst should be used. In the case of fluidized-bed systems, the resulting particles must also be sufficiently small and dense to ensure fluidization without washout. If active microorganisms are used, immobilization can be carried out by interaction of the cell with a particulate surface or by encapsulation or entrapment of the organisms into a solid matrix such as a hydrocolloidal gel. The latter approach is of particular interest for systems where a well-defined microbial population is to be maintained, especially if system asepsis cannot be ensured. 9 refs., 2 figs., 2 tabs.

36666 (DND/RDB–1/88) **Superconductivity. Recent developments and defence applications (U).** MacPherson, R.W. Department of National Defence, Ottawa, ON (Canada). Research and Development Branch. 1988. V (MICROLOG–88-05995). Available from Canada Dept. of National Defence, 101 Colonel By Dr., 2NT, National Defence Headquarters, Ottawa, ON, Canada K1A 0K2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The recent discovery of a new class of superconducting materials that exhibit superconducting properties at temperatures high enough that cooling can be obtained with liquid nitrogen has aroused interest in the identification of a number of potential uses for these materials. A review of defence-related applications is presented, based on a survey of the literature and of scientists working in the field. The background to the discovery of the new superconductors is summarized, and the properties of the new materials are contrasted with those of conventional superconductors. Research activities in the field of high-temperature superconductivity around the world are outlined. Most of the applications envisioned for the new superconducting materials are extensions of devices or systems already explored or exploited with conventional superconductors, and fall into such categories as microelectronics, sensor technology, electromagnetic propulsion, energy storage devices, medical apparatus, frictionless bearings, and power transmission. It is felt that defence applications involving SQUID devices and superconducting magnets should appear relatively soon. 36 refs.

36667 (DOE/ER/45254–3) **Staging in layer intercalates: Progress report, 1 June 1988–31 May 1989.** Fischer, J.E. Pennsylvania Univ., Philadelphia, PA (USA). Board of Trustees. 7 Dec 1988. 4p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER45254. Order Number DE89014860/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The emphasis has been on detailed studies of staging, melting and shear dynamics in Li-GIC's with exploratory work on a prototype acceptor GIC, Li_xTiS_2, polyacetylene and BiSrCaCuO single crystals. Work is briefly described in the following areas: elastic interactions and staging; high-t in-plane structure in LiC_6; staging, melting and shear dynamics in Li_xC_6; in-plane ordering and stage disorder in C_8AsF_5; and staging in doped polymers.

36668 **Chemistry and microstructure at metal-polymer interfaces.** Ho, P.S. (IBM Thomas J Watson Research Center, Yorktown Heights, NY (USA)); Haight, R.; White, R.C.; Silverman, B.D. pp. 12 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

This paper summarizes the present knowledge of the chemistry and microstructure at metal-polymer interfaces formed on PMDA-ODA polyimide. The nature of chemical bonding was deduced from electronic structures observed by photoemission spectroscopies and interpreted by molecular orbital calculations. Bonding at the initial coverages of the metals studied are well described by the formation of metal-polymer complexes as a result of delocalized charge transfer from the metal to the polymer repeat unit. The microstructure was observed directly by transmission electron microscopy and ion scattering techniques. The morphology was found to be strongly dependent on the chemical reactivity of the interface. This correlation between chemistry and microstructure is important for understanding adhesion at the metal-polymer interface.

36669 **Molecular dynamics study of the structure and properties of twist boundaries.** Counterman, C. (Massachusetts

Institute of Technology, Cambridge (USA)); Chen, L.Q.; Kalonji, G. pp. 12 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Molecular dynamics simulations of the structure and thermodynamic properties of Σ5 (001) twist boundaries were performed. The systems interacted through interatomic potential functions chosen to represent Ar and NaCl, and the simulations were conducted over a range of temperatures from low temperature to bulk melting. Excess thermodynamic properties were calculated through the use of perfect crystal reference systems. Structural changes with temperature were assessed with a variety of techniques, including the use of bicrystal Patterson functions. Both systems exhibit significant disordering at the grain boundaries at temperatures below bulk melting, a disorder which increases quite continuously with temperature. The NaCl system remains well ordered up to much higher relative temperatures than does the Ar system.

36670 Grain boundaries and antiphase boundaries in GaAs. Cho, N.H. (Cornell Univ., Ithaca, NY (USA)); McKernan, S.; Wagner, D.K.; Carter, C.B. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Bicrystals of GaAs with a predetermined orientation relationships between the grains have been produced by growing GaAs epilayers on substrates cut from Czochralski-grown germanium bicrystals. Grain boundaries have also been generated in GaAs epilayers grown on (110) Ge substrate. In this report, an extensive study of such interfaces is illustrated by a transmission electron microscopy (TEM) study of the atomic structure of first-, second- and third-order twin boundaries. Antiphase boundaries (APBs) have also been produced in GaAs epilayers grown epitactically on Ge substrates. Both the structure of these interfaces and the interactions of the APBs with grain boundaries and lattice dislocations have been examined using TEM.

36671 Atomic structure of vitreous interfacial films in sialon. Thorel, A. (Ecole des Mines de Paris, Evry (France)); Laval, J.Y.; Broussaud, D. pp. 4 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Atomic resolution imaging of siliceous interfacial films in a sialon has been achieved using transmission electron microscopy at 1000 KV. Although such films have always been reputed as vitreous, the authors show that they are at least partially crystallized. An atomic model is proposed and simulated. The stability of these films is discussed when special crystallographic relationships exist between the two adjacent grains.

36672 Structure and local electrical properties of grain boundaries in polycrystalline semiconductors. Laval, J.Y. (Laboratoire des Microstructures, Paris (France)); Pinet-Berger, M.H.; Cabanel, C. pp. 12 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The electrical properties of polycrystalline semiconductors are strongly related to their intergranular microstructures. It is first shown how the electrical behavior of carriers can be basically deduced from the electronic structure of simple interfaces. Experimentally, bulk methods do not have usually a sufficient spatial resolution and do not permit a direct correlation between the local structure and the electrical properties. Local investigations, especially by in situ techniques in transmission electron microscopy are reported. Finally the key role of the distribution of the different types of boundaries to relate the local properties to the bulk behavior is underlined.

36673 EBIC and DLTS measurements of SI- and polycrystalline silicon. Bary, A. (Universite de Caen (France)); Hamet, J.F.; Ihlal, A.; Chermant, J.L.; Nouet, G. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Influence of grain boundaries on the electronic properties of silicon has been studied by electron-beam induced current (EBIC), thermally stimulated capacitance (TSCAP) and deep-level transient spectroscopy (DLTS). Low-angle grain boundaries taken from as-grown polycrystalline wafers for solar cells have been analyzed by EBIC and their behaviors have been compared after the junction diffusion treatment. This treatment gives a decrease of the local diffusion length and recombination velocity of the minority carriers. TSCAP and DLTS methods have been applied to a coincidence orientation grain boundary Σ13. These measurements have been made on a gold diffused bicrystal which was homogenized by annealing. These results are then compared with those of a bicrystal without gold diffusion but with the same thermal treatment. After annealing a narrow interface state continuum appears. On the contrary the gold diffusion prevents the formation of this continuum and only the donor level of gold is detected in the space charge region of the grain boundary (0 - 0.5 μm). This diffusion of phosphorus or gold can be interpreted as a grain boundary passivation.

36674 (FCC–068-D-129-P2) **A field evaluation of four wood pole groundline preservative formulations using western Canadian wood species.** Ruddick, J.N.R. Forintek Canada Corp., Vancouver, BC (Canada). Western Forest Products Lab. 1987. 141p. (CE–02627). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The objective of the study was to determine whether copper-8-quinolinolate, copper naphthenate or bis(tributyltin) oxide (TBTO) are equivalent to pentachlorophenol in extending the service life of utility poles in western Canada, when applied as a groundline in-situ treatment using the pressure spade. Stubs prepared from utility poles were installed in a test plot and pressure spade treated with the four preservative greases. The preservative content of each pole stub was determined prior to remedial treatment and after one and three years of exposure. Bioassays on core samples removed from the stubs assessed changes in the protection against standard wood destroying fungi. The limited penetrations recorded (< 6 mm) suggested that improved protection is due primarily to the grease at the pole-soil interface. Evaluation of the grease retentions showed that all four formulations should have enhanced protection, in the 0-6 mm assay zone. The bioassay test showed that only TBTO and pentachlorophenol reduced fungal growth, an observation that may be related to the fact that both have a positive vapor pressure. Based upon both the chemical retention data and the bioassays, it was concluded that either copper naphthenate or TBTO, or even a mixture of both, could be used as alternatives to pentachlorophenol for use in grease remedial treatment. 22 refs., 32 figs., 28 tabs.

36675 (FRCEA-TH–182) **Characterization by positron annihilation of vacancies in gallium arsenide.** Stucky, M. Paris-11 Univ., 91 - Orsay (France); Institut National des Sciences et Techniques Nucleaires (INSTN), Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Jan 1987. 139p. (In French). Order Number DE89789256/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

Lifetime of positrons is used for evidencing vacancies in native or electron irradiated gallium arsenide. Temperature effects and dopping effects on proton trapping in vacancies are studied. In irradiated and non-irradiated GaAs positron response to a given temperature is dependent on Fermi level position. In native GaAs the positron is trapped only in n materials. Two types of traps T1 and T2 are found in n-doped (by Te or Sn) GaAs. At low doping trapping is obtained mainly by T2 for T<100K and by T1 for T>250K, between 100-250K both trappings occur. When doping increases T1 traps decrease. T1 and T2 traps disappear after annealing at 700-800K or electron irradiation at 300K. These 2 traps are attributed to a vacancy with two configurations dependent on Fermi level position. In irradiated GaAs, two types of vacancies occur. The first one is neutral or negative is annealed between 250

and 350K and is identified to a complexed or isolated gallium vacancy. The second one is neutral or negative in n materials, annealed around 500K and identified to an arsenium vacancy associated to a gallium interstitial.

36676 (INIS-mf–11987) **Radiation damages in silicon induced by highly energetic electrons and protons.** Wondrak, W. Frankfurt Univ. (Germany, F.R.). Fachbereich 13 Physik. 23 Jan 1986. 201p. (In German). Order Number DE89788626/JAW. Available from NTIS (US Sales Only), PC A10/MF A01.

In the present thesis physical radiation effects in silicon are investigated, which were produced by high-energetic electrons and protons. Emphasis was laid on those energy and fluence ranges which are important for the production of recombination centers in devices. By means of DLTS several defect levels were found. (BHO).

36677 (KFK–4563) **Ion beam modification and analysis of thin $YBa_2Cu_3O_7$ films.** Meyer, O. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Festkoerperphysik. Apr 1989. 38p. Order Number DE89788424/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The application of ion beams for the analysis and modification of high Tc superconductors is reviewed. Ion backscattering and channeling spectroscopy is used to optimize the film composition and the epitaxial growth performance on various single crystalline substrates. The influence of radiation damage on the transport properties and on the structure of polycrystalline as well as of single crystalline thin films is presented. The irradiation induced metal to insulator phase transition is discussed in detail. Some applications including the use of ion implantation for structuring are summarized.

36678 (MLM–3592(OP)) **The effective utilization of differential scanning calorimetry (DSC) to assess molded parts.** Kaye, C.J. EG and G Mound Applied Technologies, Miamisburg, OH (USA). 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-8905165–1: ANTEC '89, New York, NY, USA, 1-4 May 1989). Order Number DE89014737/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A widely accepted method for determining degree of cure of diallyl pthlalate (DAP) resin based molded parts is differential scanning calorimetry (DSC). The differential scanning calorimeter is a laboratory instrument which measures the exothermic heat of reaction as the thermosetting molding compound undergoes polymerization (cure). It is standard industry practice to utilize the data from this analysis to assign the percentage of cure for the molded part. This practice was addressed for several reasons. First, the DSC versus cure time is not a linear function. However, the usual convention specifies a linear scale for the percentage cure. This can cause concern for the customer when this calculated "percentage cure" is below a value that is perceived as acceptable. This perception is often based on a psychological premise as to the quality of the part as it relates to the percentage cure and not to the associated physical properties of the part. 3 refs., 3 figs., 1 tab.

36679 (NRCC–29443) **Abrasion-erosion resistance of various repairing mortars.** Mirza, J.; Turenne, S.; Masounave, J. Institut de Recherche d'Hydro-Quebec, Varennes, PQ (Canada); National Research Council of Canada, Boucherville, PQ (Canada). Industrial Materials Research Inst. [1989]. 27p. (MICROLOG–89-00593). Available from Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Slurry erosion tests were made in order to determine the factors influencing the abrasion-erosion resistance of some mortars. Such mortars would be used to repair concrete hydraulic structures subjected to erosion, such as those found in hydroelectric power plants. The apparatus used produced a slurry jet which impinged the surface of mortar speciments with an incidence angle of 45^0 and a velocity of 18.5 m/s. The results showed that the epoxy mortars were the most erosion wear resistant compared with grouts and polymer mortars. The wear of mortars is controlled by the wear of the binder (epoxy or cement) and a strong relation exists between the erosion resistance of the mortar and the absence of microporosity in the binder. The results also suggest minimizing the exposed areas of the binder by using sand particles with a wide size distribution. 7 refs., 7 figs., 2 tabs.

36680 Scattering, deformation, and fracture in polymers. Materials Research Society symposia proceedings. Volume 79. Wignall, G.D.; Crist, B.; Russell, T.P.; Thomas, E.L. 454p. Materials Research Society, Pittsburgh, PA (1987). (CONF-861207–: Materials Research Society fall meeting, Boston, MA, USA, 1-5 Dec 1986).

This book contains over 40 papers. Some of the titles are: Computer simulation of stress-strain behavior in polymeric materials; Neutron scattering from charged polymer lattices; EXAF analysis of ionomers; Impact of isotope effects on the small angle neutron scattering analysis of amorphous polymers; and Studies of molecular orientation in deformed semi-crystalline polymers by x-ray scattering employing synchrotron radiation.

36681 The preparation of TEM specimens from hazardous or difficult materials. Sklad, P.S. (Metals and Ceramics Div., Oak Ridge National Lab., P.O. Box X, Oak Ridge, TN (US)). v.v of Specimen preparation for transmission electron microscopy of materials. Bravman, J.C.; Anderson, R.M.; McDonald, M.L. Materials Research Society, Pittsburgh, PA (1988). (CONF-871297–: Symposium on specimen preparation for transmission electron microscopy of materials, Boston, Massachusetts, USA, 3 Dec 1987).

The first, and often the most critical step in any electron microscopy investigation is the preparation of an electron transparent specimen which is representative of the bulk material and in which the features of interest can be clearly observed and interpreted. However, for many materials of technological importance, specimen preparation procedures are far from routine. The application of standard, established techniques may be limited by material inhomogeneities, by physical constraints such as size or geometry, or by material constraints such as toxicity, radioactivity, or reactivity. Examples illustrating techniques for overcoming some of these difficulties are reviewed.

36682 Thermal fracture in selected nonlinear optical materials. Eimerl, D. (Lawrence Livermore National Lab., P.O. Box 5508, L-490, Livermore, CA (US)); Marion, J.; Graham, E.K. v.v of New slab and solid-state laser technologies and applications. Guch, S.; Eggleston, J. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1987). (CONF-870132–: OE/LASE '87, Los Angeles, CA, USA, 11-16 Jan 1987).

It is well-known that under uniform heating, a thin plate develops a quadratic temperature profile with the thermal gradient normal to the plate surface. The central part of the plate is warmer than the surfaces, and also undergoes thermal expansion. The thermal expansion normal to the surface produces no stress, but the thermal expansion parallel to the plate surface puts the surface in tension and the central part in compression. A simple but useful model of the plate treats it as a set of three isothermal plates arranged in the order cold-warm-cold. The warm part is ΔT warmer than the cold surfaces, and left to itself it would expand by $\alpha\Delta T$. Being constrained by the surface, it is in compression. If the warm part had infinite modulus, the resulting strain in the surface would be $\alpha\Delta T$. Because it relaxes, the actual surface strain is reduced by 1/3. By Hooke's law the stress is proportional to the strain, so that the surface stress is simply 2/3 . $E\alpha\Delta T$, where E is Young's modulus. It is also well-known that a material under strain in one direction changes its dimensions in the transverse directions. The surface regions are under tension, and therefore they acquire a component of strain normal to the plate surface.

36683 Fracture mechanisms and strengthening of slab lasers. Marion, J.E. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 5508, L-490, Livermore, CA 94550 (US)). v.v of New slab and solid-state laser technologies and applications. Guch, S.; Eggleston, J. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1987). (CONF-870132–: OE/LASE '87, Los Angeles, CA, USA, 11-16 Jan 1987).

The fracture mechanisms of slab lasers are examined and the critical defects, induced during optical fabrication, are identified. A rationale for determining an appropriate operating stress for the slab laser is outlined, based on Weibull statistics, and this method is experimentally assessed in full-sized slab fracture tests. Techniques

for achieving strong slabs are then examined. The authors determine that strengthening by subsurface damage minimization has the highest potential for strengthening, but that slab durability must also be enhanced in order for the slab to remain strong in practice. Good chemical durability is achieved by the use of water-proof overcoats. Good mechanical durability is achieved by the use of compressive surface layers. The compressive surface layers prevent the deterioration in slab strength from physical damage to the slab surface.

36684 Compton profile of graphite and lithium-intercalated graphite. Chou, M.Y. (Dept. of Physics, Univ. of California, CA (US)); Cohen, M.L.; Louie, S.G. v.v of Graphite intercalation compounds. Eklund, P.C.; Dresselhaus, M.S.; Dresselhaus, G. Materials Research Society, Pittsburgh, PA (1984). (CONF-841157–: Materials Research Society annual meeting, Boston, Massachusetts, USA, 26-29 Nov 1984).

The momentum distribution of the valence electrons in graphite and lithium-intercalated graphite LiC_6 is studied by calculating the Compton profiles. The wave functions are generated from a self-consistent calculation using the pseudopotential method within the local density functional formalism and a mixed basis set consisting of plane waves and linear combinations of atomic orbitals. Compton profiles along the (0001) direction are presented for both graphite and LiC_6. The difference between profiles of LiC_6 and graphite exhibits characteristic features which provide information about the change in the electronic properties resulting from intercalation.

36685 Cross-sectioning magnetic thin films for TEM. Ho, H.M. (Dept. of Materials Science and Mineral Engineering and Materials and Chemical Sciences Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)); Thomas, G.; Schooley, C.N.; Gau, J.S. v.v of Specimen preparation for transmission electron microscopy of materials. Bravman, J.C.; Anderson, R.M.; McDonald, M.L. Materials Research Society, Pittsburgh, PA (1988). (CONF-871297–: Symposium on specimen preparation for transmission electron microscopy of materials, Boston, Massachusetts, USA, 3 Dec 1987).

Oblique incidence magnetic thin film are considered to be the most appropriate recording media for the next generation of video tape applications. In order to study the microstructure of such thin films, a specimen preparation technique employing ultramicrotomy has been developed. Because oblique incidence thin films have a porous structure and poor adhesion to the substrate, the problem of splitting of the thin films from the substrate is severe. This problem is reduced considerably by the following exercises: using an acrylic embedding resin e.g. LR White, thorough degreasing with solvents, using a 55^0 diamond knife and trimming the block with a microtome before actual sectioning. The details of this preparation technique and some results obtained with this technique are presented.

36686 Preparation of semiconductor cross sections by cleaving. Hetherington, C.J.D. (National Center for Electron Microscopy, Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). v.v of Specimen preparation for transmission electron microscopy of materials. Bravman, J.C.; Anderson, R.M.; McDonald, M.L. Materials Research Society, Pittsburgh, PA (1988). (CONF-871297–: Symposium on specimen preparation for transmission electron microscopy of materials, Boston, Massachusetts, USA, 3 Dec 1987).

The practical details are presented for preparing cross-sectional samples of semiconductor epitaxial layers by cleaving. Examples of results are shown and a number of possible applications for the samples are discussed. A variation of the method can be used to prepare a TEM sample of a high T_c superconductor.

36687 The use of glass slides for preparing cross-section TEM samples of discrete transistors. Cowden, W.G. (Dept. of Chemical and Nuclear Engineering, Univ. of New Mexico, Albuquerque, NM (US)); Datye, A.K. v.v of Specimen preparation for transmission electron microscopy of materials. Bravman, J.C.; Anderson, R.M.; McDonald, M.L. Materials Research Society, Pittsburgh, PA (1988). (CONF-871297–: Symposium on specimen preparation for transmission electron microscopy of materials, Boston, Massachusetts, USA, 3 Dec 1987).

A procedure for preparing cross-section samples of specific regions on an integrated circuit die is outlined. The procedure involves the use of glass slabs to prepare the sample stack used for cross-sectioning. The transparent glass slabs on the top surface of the die enable monitoring of the region of interest during the thinning process. This ensures that the region of interest is located in the electron-transparent section used for TEM imaging. Samples prepared using this technique are sturdy enough to survive successive thinning and observation in a TEM. The glass slides do not give any charging problems and generally thin much slower than the silicon so as to provide added stability to the sample. An additional advantage is that the sample thickness can be accurately measured using the vernier attachment on an optical microscope during the sample thinning process. The imaging of specific NMOS transistors fabricated on buried oxide layers is illustrated.

36688 Preparation of zeolites for TEM using microtomy. Csencsits, R. (Center for Advanced Materials, Materials and Chemical Sciences Div., Lawrence Berkeley Lab. (US)); Gronsky, R. v.v of Specimen preparation for transmission electron microscopy of materials. Bravman, J.C.; Anderson, R.M.; McDonald, M.L. Materials Research Society, Pittsburgh, PA (1988). (CONF-871297–: Symposium on specimen preparation for transmission electron microscopy of materials, Boston, Massachusetts, USA, 3 Dec 1987).

The application of microtomy to Transmission Electron Microscopy (TEM) specimen preparation of zeolite catalysts is explained. Using a new acrylic resin (LR White) thin section ($\leq$60 nm) may be cut with relative ease. Although the details described are specific to catalysts, microtomy and the use of acrylic resin are applicable to any hard ceramic powder sample.

36689 Breathing mode lattice relaxation associated with carrier emission and capture by deep electronic levels in silicon. Samara, G.A. (Sandia National Labs., Albuquerque, NM (US)). v.v of Defects in electronic materials. Stavola, M.; Pearton, S.J.; Davies, G. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711157–: Symposium on defects in electronic materials, Boston, Massachusetts, USA, 30 Nov - 1 dec 1987).

The breathing mode (volume) lattice relaxations associated with carrier emission and capture are evaluated for a variety of deep levels in silicon using a recently proposed method based on high pressure measurements of the emission rates and capture cross sections. Included are (1) the vacancy-like acceptor levels associated with the oxygen-vacancy pair (or A-center) and the gold, platinum and palladium impurities, (2) the chalcogenide donors in their singly- and doubly-charged states and (3) a number of 3d transition metal donors. The signs and magnitudes (which range from –0 to $5A^3$/emitted carrier) of these relaxations are discussed in terms of models for the impurities and defects responsible for the associated levels. The results on the chalcogenides are compared with recent theoretical calculations.

36690 Depth-dependent character of extended defects in ion-implanted and RTA'd Si. Herring, R.A. (Martin Marietta Labs., 1450 South Rolling Road, Baltimore, MD (US)). v.v of Defects in electronic materials. Stavola, M.; Pearton, S.J.; Davies, G. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711157–: Symposium on defects in electronic materials, Boston, Massachusetts, USA, 30 Nov - 1 dec 1987).

The character of extended defects formed in high-energy S-ion implanted and rapid thermal annealed (RTA'd) Si has been found by transmission electron microscopy (TEM) to be dependent on the depth at which the defects have formed in the ion-implanted regions. Si implanted with 6 MeV S-ions and RTA'd at 1000^0C for 10 s showed a buried layer of extended defects with unfaulted loops towards the top and faulted loops towards the bottom. At higher S fluences, all the loops were unfaulted, some loops coalesced to form a dislocation network, and SiS precipitates were formed. At higher RTA temperatures, all the looper were unfaulted. A few possibilities that could explain the difference in defect character are discussed.

36691 Hexagonal silicon. Pirouz, P. (Dept. of Materials Science and Engineering, Case Western Reserve Univ., Cleveland, OH (US)); Chaim, R.; Dahmen, U. v.v of Defects in electronic materials. Stavola, M.; Pearton, S.J.; Davies, G. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711157–: Symposium on defects in electronic materials, Boston, Massachusetts, USA, 30 Nov - 1 dec 1987).

It is shown that indentation-induced formation of hexagonal silicon at the temperature range 400-700^{0}C is fully consistent with its occurence via a martensitic transformation. After presenting HREM images of hexagonal ribbons in a diamond cubic matrix, a crystallographic analysis of the phase transformation is given, and a dislocation mechanism responsible for the transformation is discussed.

36692 Interactions of implanted carbon with oxygen and nitrogen in silicon. Stein, H.J. (Sandia National Labs., Albuquerque, NM (US)). v.v of Defects in electronic materials. Stavola, M.; Pearton, S.J.; Davies, G. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711157–: Symposium on defects in electronic materials, Boston, Massachusetts, USA, 30 Nov - 1 dec 1987).

Carbon has been implanted into Si to overlap implanted concentrations of oxygen and nitrogen. Impurity incorporation and interactions produced by implantation at 50^{0}C, and upon subsequent annealing to 900^{0}C, were monitored by infrared absorption. Implantation with O and C introduces absorption bands for C-O centers in addition to those for substitutional C, interstitial O, and O-vacancy centers. These centers are removed by annealing. The major effect of C in N-implanted layers is a suppression of absorption bands associated previously with N aggregates. There is, apparently, a strong interaction between C and displacement defects which can alter defect reordering and control the loss of C from substitutional sites.

36693 Specimen cage modification for TEM in-situ shearing. Meike, A. (Earth Sciences Div., Lawrence Berkeley Lab., Univ. of California Berkeley, CA (US)). v.v of Specimen preparation for transmission electron microscopy of materials. Bravman, J.C.; Anderson, R.M.; McDonald, M.L. Materials Research Society, Pittsburgh, PA (1988). (CONF-871297–: Symposium on specimen preparation for transmission electron microscopy of materials, Boston, Massachusetts, USA, 3 Dec 1987).

In-situ strain experiments with the electron microscope have contributed substantially to our understanding of deformation in metals and ceramics. However, physical characteristics of rock-forming minerals limit the direct application of experimental procedures developed for metals. The minerals muscovite ($KAl_2(Si_3Al)O_{10}(OH,F)_2$) and biotite ($K(Mg_{0.6-1.8}Fe_{2.4-1.2})(Si_3Al)O_{10}(OH,F)_2$) are chosen to develop techniques for preliminary deformation experiments. The present communication describes modifications of sample preparation techniques for micas. The standard tensile straining configuration is altered to a simple shear geometry by means of an intermediary specimen cage to allow the use of a more favorable sample orientation. The extension of the shearing geometry to the in-situ deformation of other rock-forming minerals is discussed.

36694 Effects of carbon concentration upon oxygen precipitation in Cz Si. Hahn, S. (Siltec Silicon, Menlo Park, CA (US)); Arst, M.; Ritz, K.N.; Shatas, S.; Rek, Z.U.; Tiller, W.A.; Stein, H.J. v.v of Defects in electronic materials. Stavola, M.; Pearton, S.J.; Davies, G. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711157–: Symposium on defects in electronic materials, Boston, Massachusetts, USA, 30 Nov - 1 dec 1987).

Effects of high carbon concentration upon oxygen precipitate formation in Cz silicon have been investigated by combining various furnace and rapid thermal anneals. Even though oxide precipitate density increases with increasing carbon levels, C_s, synchrotron radiation section topographs of processed high carbon content wafers (Cs – 4 ppma) exhibit Pendellosung fringes, indicating a strain free bulk state. Our optical microscopic data have also shown very few detect etch features inside the bulk. A model based upon a direct coupling of both SiO_2 and Si-C complex formation reactions is used to explain rather unique oxygen precipitation characteristics in the high carbon content Cz Si materials.

36695 The structure of the boron-hydrogen complex in silicon. Marwick, A.D. (IBM T.J. Watson Research Center, Yorktown Heights, NY (US)); Oehrlein, G.S.; Barrett, J.H.; Johnson, N.M. v.v of Defects in electronic materials. Stavola, M.; Pearton, S.J.; Davies, G. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711157–: Symposium on defects in electronic materials, Boston, Massachusetts, USA, 30 Nov - 1 dec 1987).

Channeling and lattice location has been used to investigate the structure of the boron-hydrogen complex in crystalline silicon. The positions of both the boron and hydrogen atoms have been determined. The results are compared with Monte-Carlo simulations. The boron atom in the B-H pair is found to be displaced from a substitutional site by 0.28±0.03A, while the hydrogen atom is predominantly at a bond-center site, with a small proportion in a back-bonded position.

36696 Optical reflectance studies of $C_{24}K$ and $C_{24}K(NH_3)$. Hoffman, D.M. (Univ. of Kentucky, Lexington, KY (US)); Rao, A.M.; Doll, G.L.; Eklund, P.C.; York, B.R.; Solin, S.A. v.v of Graphite intercalation compounds. Eklund, P.C.; Dresselhaus, M.S.; Dresselhaus, G. Materials Research Society, Pittsburgh, PA (1984). (CONF-841157–: Materials Research Society annual meeting, Boston, Massachusetts, USA, 26-29 Nov 1984).

In 1954 the synthesis of the potassium-ammonia GIC's was reported. These ternary compounds are now being studied extensively because of recent observations of staging transitions and tuneable intercalate layer thickness associated with variable concentrations of NH_3 in the intercalate layer. The stage n ternary GIC's $C_{24n}K(NH_3)_x$ (n=1,2,3) can be prepared by the reaction of the stage n+1 binary GIC's $C_{24n}K$ with the vapors of NH_3. In this paper the authors report the results of optical reflectivity studies on the NH_3-saturated stage 1 ternary and $C_{24}K$ in the photon energy range 0.4-6 eV. The data were analyzed via Kramers-Kronig analyses to separate intra- and inter-band contributions to the dielectric function. By comparison of the optical results obtained for the binary and ternary GIC's the authors were able to determine the change in charge transfer between the intercalate and carbon layers induced by the NH_3-intercalation. Since the carbon layers in $C_{24}K(NH_3)$ are separated by 6.63 A the authors anticipate only weak C-C interlayer coupling. The data are therefore also discussed in terms of the quasi-2D model applied previously to acceptor GIC's.

36697 Absolute pressure derivatives of deep level defects in III-V semiconductors. Nolte, D.D. (Center for Advanced Materials Lawrence Berkeley Lab. and Univ. of California, Berkeley (US)); Walukiewicz, W.; Haller, E.E. v.v of Defects in electronic materials. Stavola, M.; Pearton, S.J.; Davies, G. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711157–: Symposium on defects in electronic materials, Boston, Massachusetts, USA, 30 Nov - 1 dec 1987).

Based on transition metal reference levels, we present absolute pressure derivatives for band-edges in GaAs and InP and defects in GaAs. The defect deformation potentials are directly related to the electron-lattice coupling which drives lattice relaxation around the defects. The authors find an exceedingly large inward lattice relaxation of the EL2 defect in GaAs upon electron emission.

36698 Fermi level stabilization in semiconductors. Walukiewicz, W. (Center for Advanced Materials, Lawrence Berkeley Lab., Univ. of California, 1 Cyclotron Road, Berkeley, CA (US)). v.v of Defects in electronic materials. Stavola, M.; Pearton, S.J.; Davies, G. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711157–: Symposium on defects in electronic materials, Boston, Massachusetts, USA, 30 Nov - 1 dec 1987).

The authors propose the existence of a Fermi level stabilization energy in III-V semiconductors which provides a reference level for the electronic part of defect annihilation energies. It is shown that the position of the stabilization energy with respect to the band edges determines the maximum free carrier concentration which can be obtained through doping. The proposed model accounts for previously unexplained trends in implant activation efficiency in III-V semiconductors.

36699 Lattice relaxation of the DX centers in $Ga_{1-x}Al_xAs$ and of the pressure-induced deep donors in GaAs. Li, M.F. (Dept. of Physic, Univ. of California, Berkeley, CA (US)); Shan, W.; Yu, P.Y.; Hansen, W.L.; Weber, E.R.; Bauser, E. v.v of Defects in electronic materials. Stavola, M.; Pearton, S.J.; Davies, G. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711157–: Symposium on defects in electronic materials, Boston, Massachusetts, USA, 30 Nov - 1 dec 1987).

Deep Level Transient Spectroscopies (DLTS) and capacitance transient techniques have been applied to GaAs:Si and to

$Ga_{1-x}Al_xAs$:Te (x=0.35) under quasi-hydrostatic pressure using a diamond anvil cell. By substituting the experimental pressure coefficients of the defect energies into a model proposed, the authors concluded that both the DX center in the GaAlAs alloy and the pressure-induced deep donor (PIDD) in GaAs have large lattice relaxations associated with them.

36700 Pressure-dependent DLTS experiments on Si-doped AlGaAs. Farmer, J.W. (Univ. of Missouri Research Reactor Facility, Research Park, Columbia, MI (US)); Hjalmarson, H.P.; Samara, G.A. v.v of Defects in electronic materials. Stavola, M.; Pearton, S.J.; Davies, G. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711157–: Symposium on defects in electronic materials, Boston, Massachusetts, USA, 30 Nov - 1 dec 1987).

Pressure dependent Deep Level Transient Spectroscopy (DLTS) experiments are used to measure the properties of the deep donors (DX-centers) responsible for the persistent photoconductivity effect in Si-doped AlGaAs. The sample dependence of the DLTS spectra shows evidence for a defect complex involved in the DX-center.

36701 A comparison of fatigue crack propagation in Modes I and III. Ritchie, R.O. (Materials and Chemical Sciences Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). v.v of Proceedings of the eighteenth national symposium on fracture mechanics. Read, D.T.; Reed, R.P. ASTM, Philadelphia, PA (1988). (CONF-850679–: 18. American Society for Testing and Materials national symposium on fracture mechanics, Boulder, Colorado, USA, 25-27 Jun 1985).

The propagation behavior of fatigue cracks in Mode III (anti-plane shear), measured under cyclic torsion, is described and compared with more commonly encountered behavior under Mode I (tensile opening) loads. It is shown that a unique, global characterization of Mode III growth rates, akin to the Paris law in Mode I, is only possible if characterizing parameters appropriate to large-scale yielding are employed and allowance is made for crack tip shielding from sliding crack surface interference (that is, friction and abrasion) between mating fracture surfaces. The magnitude of this interference, which is somewhat analogous to crack closure in Mode I, is further examined in the light of the complex fractography of torsional fatigue failures and the question of a fatigue threshold for Mode III crack growth. Finally, micromechanical models for cyclic crack extension in anti-plane shear are briefly described, and the contrasting behavior between Mode III and Mode I cracks subjected to simple variable amplitude spectra is examined in terms of the differing role of crack tip blunting and closure in influencing shear, as opposed to tensile opening, modes of crack growth.

40 CHEMISTRY

Refer also to citation(s) 37417, 37679

36702 (INIS-SU–93) **Isotopes in catalysis. Issue 147. Proceedings of the Moscow Chemical Technological Institute.** Ministerstvo Vysshego i Srednego Spetsial'nogo Obrazovaniya SSSR, Moscow (USSR); Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR). 1987. 115p. (In Russian). Order Number DE89012155/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

Individual papers in these proceedings are separately indexed.

36703 (LYCEN–8754) **Periodic system of chemical elements: old and new developments.** Kibler, M. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. Sep 1987. 15p. (CONF-8709439–: 17. Congreso de quimicos Teoricos de Expresion Latina, Peniscola, Spain, 20-25 Sep 1987). Order Number DE89781494/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Some historical facts about the construction of a periodic system of chemical elements are reviewed. The Madelung rule is used to generate an unusual format for the periodic table. Following the work of Byakov, Kulakov, Rumer and Fet, such a format is further refined on the basis of a chain of groups starting with SU(2)xS0(4.2).

4001 Analytical and Separations Chemistry

Refer also to citation(s) 35545, 35644, 35733, 35764, 35766, 35790, 35965, 35967, 36431, 36481, 36649, 36680, 36810, 36850, 36852, 36856, 37138, 37217, 37356, 37746

36704 (CEGB-TPRD/L–3259/R88) **Determination of boron as boric acid by automatic potentiometric titration.** Midgley, D. Central Electricity Research Labs., Leatherhead (UK). Jun 1988. 16p. (PWR/ASG/P–87-9). Order Number DE89617891/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Boron in PWR primary coolant and related waters may be determined as boric acid by titration with sodium hydroxide, using a glass electrode as a pH indicator. With a modern automatic titrator, the analysis is quick, convenient, accurate and precise. In the titration of 8 mg B (e.g. 4 ml of 2000 mg l^{-1} solution), no significant bias was observed and relative standard deviations were about 0.25%. With 0.8 g B, a bias of about 2% appears, although this could be reduced by restandardizing the titrant, but the relative standard deviation was still < 0.5%. The lithium hydroxide added to primary coolant would cause a negative bias, but a simple correction may be applied using the routinely determined lithium concentration. The titrator is, therefore, suitable for routine use in a PWR station, where the primary coolant contains 100-2000 mg l^{-1} B, depending on the stage of the fuel cycle.

36705 (CNIC–00231) **Determination of trace gold in rocks and minerals by neutron activation analysis.** Zhao Yunlong; Zhou Suqing; Liang Yutang. China Nuclear Information Centre, Beijing, BJ (China). May 1988. 8p. (In Chinese). (BUGRI–0004). Order Number DE89613061/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The determination of trace gold in rocks and minerals by neutron activation analysis is described. Two methods are used for pre-separating and concentrating the trace gold in geological samples. one of the methods is that the samples are dissolved in aqua regia solution; activated carbon paper pulp filter is used for pre-separating and concentrating trace gold by dynamic adsorption method; then the activated carbon containing gold was ashed at 650 ~ 700 deg c. The other method is that the samples are dissolved in aqua regia solution; the polyurethane foam plastic filled with activated carbon is used for pre-separating and concentrating trace gold by dynamic adsorption method; then the foam plastic containing gold was ashed at 650 deg c. The gold in ashes is determinated by neutron activation analysis. The detection limit is 0.004ng/g. The accuracy of the method is examined by gold in reference standard material. The results of this method are in good agreement with the recommended value. For analysis of the trace gold by the methods of instrumental neutron activation analysis and epithermal neutron activation analysis, the interference of 411.8 keV γ-ray from ^{153}Sm, ^{152}Eu and fission products of uranium and the correction methods are discussed.

36706 (CONF-851011–10) **Electrically stabilized expanded beds for sorption separations.** Watson, J.S.; Byers, C.H.; Reinholt, D.R. Oak Ridge National Lab., TN (USA). 1985. 14p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 4. symposium on separation science and technology for energy applications; Knoxville, Tennessee, USA; 20-24 Oct 1985. Order Number DE89014192/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Recent studies have shown that when high electric fields are imposed on expanded fluidized beds, motion of the particles can cease. This provides the potential for fixed bed operations with the void fraction sufficiently large that only moderate pressure drops are required, even with small particles. This paper explores the dielectric forces that inhibit particle motion in alternating-current electric fields and the potential and limitations of the concept for adsorption operations. The dielectric constants of the particles and the fluid, the size of the particles, the density and viscosity of the fluid, and the imposed electric field gradient are the variables of most importance to bed stabilization. In adsorption tests, the expanded-stabilized beds perform essentially as well as densely packed fixed beds but with only a fraction of the pressure drop. 9 refs., 6 figs.

36707 (DOE/ER/13281–5) **Novel approaches to ionic chromatography: Progress report, December 1, 1987–June 30, 1989.** Dasgupta, P.K. Texas Tech Univ., Lubbock, TX (USA). Dept. of Chemistry and Biochemistry. Jul 1989. 17p. Sponsored by DOE Energy Research. DOE Contract FG05-84ER13281. Order Number DE89013942/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Work continued on ion chromatography. The following research areas are discussed: (1) fluorogenic ligands, chelating surfactants and metal determinations. The use of sulfoxines in fluorescence detection is addressed. Chromatographic detection of Al, Ga, and In was undertaken. (2) Membrane suppressers; (3) A novel suppresser reaction and detection of weak acids via indicators reactions, and (4) DC "conductivity" detection and stopped flow chromoamperomety. 18 refs., 2 figs. (CBS)

36708 (INIS-BR–1542) **Deformations in structure of the scapolites from northeast, Brazil.** Gouveia, A.H.C.; Villarroel, H.S. Sociedade Brasileira de Geologia, Recife, PE (Brazil). Nucleo do Nordeste. 1979. 12p. (In Portuguese). (CONF-7911203–: 9. symposium of geology in northeast, Natal, Brazil, Nov 1979). Order Number DE89619123/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Scapolites are relatively common constituents of calcium-rich metamorphic rocks. They can be considered as members of the solid solution series marialite and meionite. Relationship between the optical properties, chemical composition and X-ray diffraction data shows that scapolites from northern Brazil are mizzonites and meionites. The structures of these minerals are compatible only with a primitive lattice. The d_{hkl} peaks of natural scapolites are outside the range shown by the two pure end-members of the series, and the unit-cell dimensions increase with percentage of $(K+SO_4)$. X-ray diffraction powder data for natural tetragonal and orthorhombic calcium-rich scapolites are detailed in five tables.

36709 (INIS-BR–1544) **Petrology and mapping of Fe and Ti occurences in Passira country, PE, Brazil.** Silva Filho, A.F. da; Pinho Guimaraes, I. de. Sociedade Brasileira de Geologia, Recife, PE (Brazil). Nucleo do Nordeste. 1979. 8p. (In Portuguese). (CONF-7911203–: 9. symposium of geology in northeast, Natal, Brazil, Nov 1979). Order Number DE89619125/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The results of a geologic mapping realized at the scale of 1:25.000, for graduating in geology, the will show in this communication. The area mapped has 230 square kilometers and it is localized between the south lattitudes of $7^0$52'30" and $8^0$42'45" and the west greenwiches of $35^0$26'49" and $35^0$33'30", at the districts of Passira and Limoeiro-PE. At the area, are recorgnized migmatites granites, biotite schists, hornblende-gneisses, quartz-diorites and amphigolites. The iron titanium ore are fitted, like xenoliths, inside the amphibolites. The amphibolites have orthorocks type, and they are derived predominatly of the quartz-diorite unit, where they may be individualized cartographicaly. On the other side of the geological mapping, we did many thin sections and polished, chemical analyses of the ore bodyes, and the results will be disciminated.

36710 (INIS-SU–89, pp. 122) **Radioisotope determination of carbon impurities in cesium polyiodates.** Yakimova, E.E. (Moskovskij Inst. Tonkoj Khimicheskoj Tekhnologii, Moscow (USSR)); Nakshbandi, Kh.; Tsvetkov, A.A.; Stepin, B.D. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM COMPOUNDS/crystallization; CESIUM COMPOUNDS/quantitative chemical analysis; IODATES/crystallization; IODATES/quantitative chemical analysis; CARBON 14; CRYSTALLIZATION; DISTRIBUTION FUNCTIONS; FORMIC ACID; IMPURITIES; IODATES; PHENOL; SENSITIVITY; TRACE AMOUNTS; TRACER TECHNIQUES

36711 (INIS-SU–89, pp. 123-124) **Determination of microimpurities of alkali and alkaline earth elements in lithium and cesium salts of high purity and in monocrystals on their basis.** Zolotovitskaya, Eh.S.; Fidel'man, B.M.; Bondareva, N.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/quantitative chemical analysis; ALKALINE EARTH METAL COMPOUNDS/quantitative chemical analysis; ABSORPTION SPECTROSCOPY; CARBONATES; EMISSION SPECTROSCOPY; HALIDES; IMPURITIES; IODATES; MONOCRYSTALS; SENSITIVITY; TRACE AMOUNTS

36712 (INIS-SU–89, pp. 123) **X-ray fluorescence determination of bromides in cesium iodide with preliminary concentrating crystallization.** Blank, A.B.; Ehksperiandova, L.P.; Shevtsov, N.I.; Alisejchik, V.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

BROMIDES/x-ray fluorescence analysis; CESIUM IODIDES/impurities; CESIUM IODIDES/quantitative chemical analysis; BROMIDES; IMPURITIES; CRYSTALLIZATION; DISTRIBUTION FUNCTIONS; MONOCRYSTALS; SENSITIVITY; SEPARATION PROCESSES

36713 (INIS-SU–89, pp. 131) **Atomic absorption determination of rubidium and cesium in complex objects.** Shatskaya, S.S. (AN SSSR, Novosibirsk (USSR). Inst. Khimii Tverdogo Tela i Pererabotki Mineral'nogo Syr'ya). AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM COMPOUNDS/absorption spectroscopy; CESIUM COMPOUNDS/quantitative chemical analysis; ACCURACY; ALKALINE EARTH METAL COMPOUNDS; BRINES; INTERFERING ELEMENTS; SENSITIVITY

36714 (INIS-SU–89, pp. 129-131) **Extraction separation of matrix during flame-photometric and atomic-absorption determination of Li, Rb, Cs in alkaline earth element salts.** Samojlov, Yu.M. (AN SSSR, Novosibirsk (USSR). Inst. Khimii Tverdogo Tela i Pererabotki Mineral'nogo Syr'ya); Shatskaya, S.S. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/absorption spectroscopy; ALKALI METAL COMPOUNDS/quantitative chemical analysis; ALKALINE EARTH METAL COMPLEXES/solvent extraction; ALKALINE EARTH METAL COMPOUNDS/quantitative chemical analysis; ACCURACY; DISTRIBUTION FUNCTIONS; IMPURITIES; MIXED SOLVENTS; PHOTOMETRY

36715 (INIS-SU–97) **International solvent extraction conference. Vol. 1. Conference papers.** AN SSSR, Moscow (USSR). 1988. 354p. (In Russian). (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01.

Individual papers in these proceedings are separately indexed.

36716 (INIS-SU–97, pp. 87-90) **Ir, NMR and conductivity study of extracts and the character of the mutual influence of metals in their extraction with alkylammonium salts.** Bagreev, V.V. (AN SSSR, Moscow (USSR). Inst. Geokhimii i Analiticheskoj Khimii); Zolotov, Yu.A.; Fischer, C.; Kardivarenko, L.M.; Popov, S.O. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Methods of IR- and NMR-spectroscopy, measurement of electric conductivity were used to study the solvent extraction of metal microamounts in thre presence of macroamounts of other elements. Dissociation constants of different trioctylalkyl and trioctylammonium complexes (including Er, Th, In complexes) in benzene and nitrobenzene were calculated. The equation, which enables to make allowance for the character of influence of all factors o microelement behaviour in macroelement presence during extraction by amines and quaternary ammonium salts, was derived. Analysis of the equation shows, that the degree of suppression of microelement extraction grows with increase of concentration of alkylammonium common ion, macroelement concentration and its dissociation constant in organic phase. 2 refs.; 3 tabs.

36717 (INIS-SU–97, pp. 135-137) **Determination of thermodynamic characteristics of extraction equillbria in the systems containing ammonium salts and organic phosphorus compounds.** Sedov, V.M. (Leningradskij Tekhnologicheskij Inst., Leningrad (USSR)); Kopyrin, A.A.; Proyayev, V.V.; Burtsev, I.A. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Consideration is being given to empirical methods of calculation and mathematical models, enabling to describe rather simple and precisely a thermodynamic equilibrium in extractive systems based on alkylammonium salts and organicophosphorus compounds. It is shown that Pitzer's and Mikulin's methods are the most suitable ones for calculation of thermodynamic activity of components in aqueous phase. The organic phase can be described most precisely by the ideal associative solution model, which takes into account the difference of association constants and additional solvation of metal-containing complex by extractant molecules. Equations for calculating association constants of tributylphosphate (TBP) and alkylammonium salts in organic solvents are given; values of additional solvation constants are presented for the following systems: $M(NO_3)_n$-TBP-benzene (where M=Ce^{3+}, Pr^{3+}, UO_2^{2+}, Th^{4+}; n=2, 3, 4) and Ce(Eu)$(NO_3)_3$-TLAcenter dotHNO_3-CCl_4, where TLAcenter dotHNO_3 - trilaurylammonium nitrate. 6 refs.

36718 (INIS-SU–97, pp. 206-208) **Extraction properties of TBP - uranyl nitrate disolvate.** Zilberman, B.Ya. (Radievyj Inst., Leningrad (USSR)); Fedorov, Yu.S. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

A study was made on solvent extraction of actinides (Pu, Np, Th, U) and F^-, Cl^-, Br^-, N_3^-, SCN^- anions in the system: aqueous nitric acid solution of uranyl nitrate (UN) in the presence of solid UN salt -tbp solution in CCl_4 at 20 deg C. It is shown that TBP-UN disolvate exhibits some specific extraction properties. Distribution coefficients of anions (F^-, Cl^-, Br^-, N_3^-, SCN^-) are much higher in the presence of UN, than in its absence. Investigation of UN salting-out properties shows that the ratio of distribution coefficients of plutonium and uranium during solvent extraction from uranium-magnesium systems with the steady salting-out effect and in solvent extraction from systems without $Mg(NO_3)_2$ is practically the same in all studied range. It is proposed, that anion-exchange properties of tbp-UN disolvate lead to actinide solvent extraction in the form of anion complexes. 3 refs.; 4 figs.

36719 (INIS-SU–97, pp. 287-290) **Metal extraction by amides of carboxylic acids.** Skorovarov, D.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR)); Chumakova, G.M.; Rusin, L.I.; Ul'anov, V.S.; Sviridova, R.A.; Sviridov, A.L. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Extraction ability of various amides was studied. Data on extraction of rare earths, vanadium, molybdenum, rhenium, uranium, niobium, tantalum by N,N-dibutyl-amides of acetic, nonanic acids and fatly synthetic acids of C_7-C_9 fractions are presented. Effect of salting-out agents, inorganic acid concentrations on extraction process was studied. Potential ability of using amides of carboxylic acids for extractional concentration of rare earths as well as for recovery and separation of iron, rhenium, vanadium, molybdenum, uranium, niobium, and tantalum was shown. 5 refs.; 3 figs.; 2 tabs.

36720 (Juel-Spez–475) **Activation analysis of air particulate matter.** Alian, A.; Sansoni, B. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung fuer Chemische Analysen. Nov 1988. 106p. Order Number DE89788344/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

This review on activation analysis of air particulate matter is an extended and updated version of a review given by the same authors in 1985. The main part is aimed at the analytical scheme and refers to rules and techniques for sampling, sample and standard preparation, irradiation and counting procedures, as well as data processing, - evaluation, and - presentation. Additional chapters deal with relative and monostandard methods, the use of activation analysis for atmosphere samples in various localities, and level of toxic and other elements in the atmosphere. The review contains 190 references.

36721 (KURRI-TR–302, pp. 16-19) **Charged particle activation analysis of light elements.** Fukushima, Hiroto (Japan Chemical Analysis Center, Chiba (Japan)). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. May 1988. (In Japanese). (CONF-8707203–: Specialist research meeting on semiconductors with research reactors; Specialist research meeting on semiconductors with research reactors, Kyoto, Japan; KUMATORI, Japan, 27 Jul 1987; 18 jan 1988;CONF-8801165–). In *Proceedings of the specialist research meetings on semiconductors with research reactors.* Order Number DE89003365/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

SEMICONDUCTOR MATERIALS/activation analysis; CARBON/activation analysis; NITROGEN/activation analysis; OXYGEN/activation analysis; IMPURITIES; TRACE AMOUNTS; CARBON; NITROGEN; OXYGEN; QUANTITATIVE CHEMICAL ANALYSIS; HELIUM 3 REACTIONS; DEUTERON REACTIONS; PROTON REACTIONS; PROTONS; NEUTRONS; ALPHA PARTICLES; CARBON 11; NITROGEN 13; FLUORINE 18

36722 (KURRI-TR–302, pp. 1-8) **Qualitative and quantitative investigation of trace impurities (about 30 elements) in Si by neutron activation analysis.** Takeuchi, Takayuki (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.); Nakano, Yukihiro. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. May 1988. (In Japanese). (CONF-8707203–: Specialist research meeting on semiconductors with research reactors; Specialist research meeting on semiconductors with research reactors, Kyoto, Japan; KUMATORI, Japan, 27 Jul 1987; 18 jan 1988;CONF-8801165–). In *Proceedings of the specialist research meetings on semiconductors with research reactors.* Order Number DE89003365/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Substances existing in the starting material for production of silicon crystals are responsible for part of the impurities in the resultant silicon crystals while the remaining of the impurities are accounted for by substances entering the material during the production of semiconductor devices. It is of great importance to make an analysis of impurities contained in the original crystal material. Such crystal material is so high in purity that a quantitative analysis technique to be used should be able to determine ppt-level impurities. The present report outlines the mechanism of an neutron activation analysis method which can be applied to the determination of impurities in crystal material. When a sample for analysis is fed into a nuclear reactor, neutrons resulting from the fission of ^{235}U hit nuclei to cause nuclear reactions, to convert the nuclei into different forms of nuclei. Such product nuclei are generally radioactive and disintegrate into daughter nuclei while releasing beta- and gamma-rays. The types and amount of elements contained in the original sample can be identified and determined by analyzing the energy of the released gamma-rays. (N.K.).

36723 (KURRI-TR–302, pp. 20-29) **Analysis of impurities in semiconductor by IMA (SIMS).** Komori, Junko (Mitsubishi Electric Corp., Itami, Hyogo (Japan). LSI Research and Development Lab.);

Masuko, Yoji; Koyama, Hiroshi. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. May 1988. (In Japanese). (CONF-8707203–: Specialist research meeting on semiconductors with research reactors; Specialist research meeting on semiconductors with research reactors, Kyoto, Japan; KUMATORI, Japan, 27 Jul 1987; 18 jan 1988;CONF-8801165–). In *Proceedings of the specialist research meetings on semiconductors with research reactors.* Order Number DE89003365/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

The report outlines the measuring mechanism of SIMS and its applications in the field of semiconductor production. SIMS is the only equipment currently available for micrometer-order analysis and ppb-level impurities detection required for evaluation of semiconductors. In SIMS, sputtering of the sample surface is performed with primary ions and the secondary ions released from the sample are analyzed to identify the atomic species existing in the surface. The sputtering process and ionization process are outlined in the report, though the details of sputtering has not been fully clarified yet. In actual observation, some problems may be caused due to interfering ions and residual ions. In general, various ions including multi-valent ions, cluster ions, molecular ions, hydrogenated/oxygenated ions and hydrocarbon ions are produced in addition to monovalent ions to interfere the atoms under analysis. Interference by these ions can cause serious problems in carrying out depth profile analysis as well as observation of mass spectra. Major applications of SIMS in the field of semiconductor production include the evaluation of silicon surface, light elements, insulating materials and semiconductor devices. Some requirements to be met by further studies are also listed. (N.K.).

36724 (KURRI-TR–302, pp. 67-73) **Techniques for utilization of nuclear reactor neutrons for semiconductor research. Current situation and problems to be solved in future.** Kimura, Itsuro (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. May 1988. (In Japanese). (CONF-8707203–: Specialist research meeting on semiconductors with research reactors; Specialist research meeting on semiconductors with research reactors, Kyoto, Japan; KUMATORI, Japan, 27 Jul 1987; 18 jan 1988;CONF-8801165–). In *Proceedings of the specialist research meetings on semiconductors with research reactors.* Order Number DE89003365/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

The report outlines various techniques to utilize neutrons obtained from a nuclear reactor in the area of semiconductor research, focusing on the current research situation and problems to be solved in the future. For research on the interaction between neutrons and semiconductors, data on nuclei used in semiconductors are essential, and transport of neutrons in semiconductors has significance in conversion-injection of neutrons. For research of the neutron field in a nuclear reactor, investigations are required for tailoring, control of irradiation environment, production and control of fine beams, and production and control of pulsed beams. For detailed analysis of impurities, investigations have been or should be carried out for nuclear activation analysis, prompt gamma-ray analysis, tracer techniques, detection of reaction particles, and measurement of detailed distribution. For analysis of structures and chemical forms, techniques have been and should be developed for neutron diffraction, small angle scattering of neutrons, inelastic scattering of neutrons, and application of Moessbauer effect to study on local structures in amorphous material. (N.K.).

36725 (LBL–24944) **Separation of low molecular weight alcohols from dilute aqueous solutions by reversible chemical complexation.** Arenson, D.R.; King, C.J. Lawrence Berkeley Lab., CA (USA). Apr 1989. 208p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE89014159/JAW. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

Thesis. Submitted by D.R. Arenson.

The removal of alcohols from dilute solutions has traditionally been performed by distillation. Since this is an energy intensive process, a large amount of the total processing cost is due to the separation and purification of the alcohol. As an alternative to distillation, extraction is investigated from both a process and a chemistry point of view for several alcohols. The goals of the project were to find effective solvent systems for removal of alcohols and to investigate the interactions occurring in the organic phase during extraction. Ethanol was examined both as a model compound and because of the interest in its production by fermentation. The four butanols were extracted in order to investigate the differences in extraction of the various isomers. Several propanols and propanediols were used also. Phenols were found to provide much higher distribution ratios for extraction of ethanol than do other common solvents. In extracting the butanol isomers it was found that the indicated activity coefficients in the organic phase were approximately the same when large concentrations of m-cresol were present. A mass-action-law model was used to obtain indicated stoichiometries for the complexes formed in the organic phase between the alcohol and m-cresol. From the complex formation constants at different temperatures, the enthalpy of complex formation was calculated for the interaction between ethanol and m-cresol. 101 refs., 75 figs., 13 tabs.

36726 (LBL–27166) **Channelling and related effects in electron microscopy: The current status.** Krishnan, K.M. Lawrence Berkeley Lab., CA (USA). May 1989. 35p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8905179–2: 8. Pfefferkorn conference on fundamental beam interactions with solids for microscopy, microanalysis and microlithography, Park City, UT, USA, 7-12 May 1989). Order Number DE89014897/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Channelling or Borrmann effect in electron diffraction has been developed into a versatile, high spatial resolution, crystallographic technique with demonstrated applicability in solving a variety of materials problems. In general, either the characteristic x-ray emissions or the electron energy-loss intensities are monitored as a function of the orientation of the incident beam. The technique, as formulated in the planar geometry has found wide applications in specific site occupancy and valence measurements, determination of small atomic displacements and crystal polarity studies. For site occupancy studies, the appropriate orientations in most cases can be determined by inspection and the analysis carried out according to a simple classification of the crystal structure discussed in this paper. Concentration levels as low as 0.1 wt% can be easily detected. The reciprocity principle may be used to advantage in all these studies, if electron energy-loss spectra are monitored, as both the channelling of the incoming beam and the blocking of the outgoing beam are included in the formulation and analysis. The formulation in the axial geometry is an useful alternative, particularly for monatomic crystals. Localization effects are important if, either the experiment is performed in the axial geometry or if low atomic number elements ($z < 11$) are detected. In general, the sensitivity to L-shells is lower compared to K-shell excitations. Other experimental parameters to be considered include temperature of the sample, the acceleration voltage and parallelism of the incident beam. Any detrimental effects of channelling on conventional microanalysis can be minimized either by tilting the crystal to an orientation where no lower order diffraction vectors are excited or by using a convergent probe such that a large range of incident beam orientations are averaged in the analysis. 49 refs., 9 figs.

36727 (MLM–3596) **An efficient palladium isotope chromatograph (EPIC) for hydrogen.** Rutherford, W.M. EG and G Mound Applied Technologies, Miamisburg, OH (USA). 20 Jun 1989. 16p. Sponsored by DOE Defense Programs. DOE Contract AC04-88DP43495. Order Number DE89014581/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The efficient palladium isotope chromatography (EPIC) system is based on a palladium displacement chromatograph developed and tested for the preparative scale separation of the isotopes of hydrogen. Rapid cycling and high efficiency are obtained by use of high-performance packing operating at an elevated temperature (80°C) and elevated pressure (1.5 atm). The process, which was tested with a 50/50 mixture of hydrogen and deuterium, depends on the exploitation of thermally driven pressure differences to recover and recycle the mixed transition zone between the bands of the pure components and also to recover and recycle the hydrogen gas used as the displacing agent. The purity of the product is significantly enhanced by partially backfilling the column with pure

deuterium at the beginning of each displacement cycle. The computer-controlled system operates continuously, and it is capable of separating 2.2 std L/hr of feed at product assays of 99.86 at. % hydrogen and 99.992 at. % deuterium. 11 refs., 5 figs., 1 tab.

36728 (NRCC/IMR–27559) **Determination of the nature and content of antioxidant and antioxidant synergist in PE and XLPE used in cables.** Crine, J.-P.; Haridoss, S.; Cole, K.C. National Research Council of Canada, Boucherville, PQ (Canada). Industrial Materials Research Inst.; Institut de Recherche d'Hydro-Quebec, Varennes, PQ (Canada). [1989]. 21p. (MICROLOG–89-00557). Available from Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

It is shown that polyethylene (PE) and cross-linked PE used for high-voltage electric cable applications contain an antioxidant synergist in addition to an antioxidant. Their nature and content have been determined by a combination of spectroscopy and neutron activation analysis measurements. The results thus obtained suggest that part of the antioxidant compound is grafted to polymer chains during crosslinking. A combination of ultraviolet and Fourier transform infrared (FTIR) spectroscopy and neutron activation analysis (or any other technique measuring sulfur) measurements were shown to allow the identification of the two components of the antioxidant compound used in PE resin for cable applications. In fact, the combination of infrared and neutron activation results is the only reliable way to evaluate the antioxidant-compound content in cross-linked PE. Note that this cannot be achieved by a single technique since ultraviolet spectroscopy is useless with cross-linked PE and cannot easily identify synergists; FTIR spectroscopy can identify the antioxidant components in unaged PE but this is much more difficult in aged PE and cross-linked PE; and the sulfur content in cross-linked PE does not give directly the fraction of functional (ungrafted) antioxidant compound. FTIR spectroscopy and neutron activation measurements reveal that the studied samples contain identical (ca 2500 ppM) antioxidant and synergist contents. 11 refs., 7 figs.

36729 (ORNL/FTR–3292) **International conference on analytical chemistry in nuclear technology, June 5–8, 1989, Karlsruhe, France: Foreign trip report.** Stokely, J.R. Oak Ridge National Lab., TN (USA). 19 Jun 1989. 8p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014232/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler attended the Second International Conference on Analytical Chemistry in Nuclear Technology and presented recent ORNL work on chemical and radiochemical analysis to characterize mixed radioactive waste. Invited papers dealt, for the most part, with analytical chemistry in nuclear fuels reprocessing and safeguards and with new analytical techniques of general interest. A wide diversity of subjects were covered in poster sessions. Subjects of particular interest were in-line and on-line process analysis using fiber optic spectrophotometry, x-ray fluorescence, and gamma-ray spectrometry, chemical characterization of radioactive waste, new neutron activation analysis methods, and use of computers and robotics in analytical chemistry laboratories.

36730 Column efficiency determination. Schudel, J.V.H. (Oak Ridge National Labs., Analytical Chemistry Div., Oak Ridge, TN (US)); Guiochon, G. v.v of 1988 Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy (abstracts). Pittsburgh Conference, Pittsburgh, PA (1988). (CONF-880204–: 39. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, New Orleans, LA, USA, 22-26 Feb 1988).

Technical Paper NO. 1152.

The authors have studied the reproducibility and bias of the measurements of the column efficiency in HPLC, using simulated peaks. Peaks of various signal to noise and tau/sigma ratios are generated by computer simulation using an exponential convoluted Gaussian model. Tau/sigma is a measure of the asymmetry of a peak, where tau is the time constant for the exponential tailing function with which the Gaussian peak, with a standard deviation of sigma, is convoluted. A noise sequence is added to the peak profile. Signal to noise ratios in the range of 50 to 10^6 are used in this study. The reproducibility of the efficiency values is defined as the relative standard deviation of ten measurements and the bias is the difference between the mean and true value. Since each peak is completely defined by the simulation program user, the true efficiency is known. Among the variables that can influence column efficiency values, the choice of the measurement or calculation method is very often overlooked. This choice can have a dramatic effect on the calculated efficiency values obtained from peaks deviating from the ideal Gaussian profile or those having a noisy baseline, as is commonly the case in chromatography. Column efficiency values from a variety of peaks are computer calculated, using eight commonly employed methods, and are compared.

36731 Optimization of separation efficiency in capillary zone electrophoresis. Jones, H.K. (Chemical Methods and Separations Group, Chemical Sciences Dept., Pacific Northwest Lab., Richland, WA (US)); Nguyen, N.T.; Yonker, C.R.; Smith, R.D. v.v of 1988 Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy (abstracts). Pittsburgh Conference, Pittsburgh, PA (1988). (CONF-880204–: 39. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, New Orleans, LA, USA, 22-26 Feb 1988).

Technical Paper NO. 643.

Capillary zone electrophoresis (CZE) is a potentially useful technique for fast, high efficiency separations of biologically important compounds such as amino acids, peptides, amines, nucleic acids, and proteins. To improve separation efficiencies in CZE, fundamental studies of the variances contributing to band-broadening and of the effects of physical and chemical parameters are required. These parameters include applied voltage, column length, column radius, injection time, pH and ionic strength of the buffer. Many such studies have been reported by Jorgenson and coworkers, but important contributions to band-spreading remain unresolved. The band-broadening in capillary zone electrophoresis can be attributed to a range of factors. The most important factors are expected to be sample specific adsorption phenomena, local perturbation of electric field strengths, sample volume, detector volume, thermal heating, and molecular diffusion. The minimization of these contributions is required to exploit the significant potential of CZE. In this study, variances contributing to the band-broadening in CZE have been investigated in fused silica capillaries with on-line fluorescence and U.V. absorption detectors.

36732 Numerical simulation of band profiles for two-component separations by displacement chromatography. Katti, A.M. (Oak Ridge National Labs., Analytical Chemistry Div., Oak Ridge, TN (US)); Guiochon, G. v.v of 1988 Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy (abstracts). Pittsburgh Conference, Pittsburgh, PA (1988). (CONF-880204–: 39. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, New Orleans, LA, USA, 22-26 Feb 1988).

Technical Paper NO. 1153.

The band profiles for the separation of a two component mixture by displacement chromatography are simulated by solving the mass balance equation for chromatography. Competitive isotherms are employed to account for non-linear effects due to the thermodynamics of solute stationary phase interactions. Fast kinetics are assumed, as well as isothermal operation, and the boundary conditions are adjusted to apply for displacement separations. The potential of displacement chromatography for preparative chromatographic separations is high, due to the formation of the displacement train where adjacent bands move at constant velocity with a minimal amount of peak overlap. The effect of various operating parameters have been investigated and their effect on the product purity and the production rate will be discussed. Additionally, the profiles obtained will be compared with experimental results.

4002 Inorganic, Organic and Physical Chemistry

Refer also to citation(s) 35526, 35538, 35545, 35547, 35644, 35664, 35731, 35915, 36469, 36509, 36662, 36692, 36694, 36710, 36716, 36730, 36731, 36732, 36858, 36859, 36861, 36944, 36949, 36983, 37746

36733 (ARC–1989, pp. 10) **Changes in pore structure of precipitated iron oxide catalysts during pretreatment and hydrocarbon synthesis reaction.** Parkash, S. (Alberta Research Council, Edmonton); Kotanigawa, T.; Chakrobartty, S.K. Alberta Research Council, Edmonton, AB (Canada). [1989]. (CE–02438). In *Alberta Research Council [research reports].* Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

In connection with studies of precipitated iron oxide catalysts for the synthesis of hydrocarbons from carbon monoxide and steam, the changes in pore structure during pretreatment and synthesis reactions were investigated. Precipitated iron oxide catalysts initially contain fine ferric oxide particles built up from spheroidal crystals of different diameters which link to form tubular capillaries with varying widths. Upon CO-steam interaction and subsequent sintering of the catalysts, smoothing of the walls of tubular produces capillaries having ink-bottle shape. Changes in surface areas with crystallite sizes, as determined by x-ray line broadening, are discussed. 12 refs., 6 figs., 3 tabs.

36734 (ARC–1989, pp. 6) **The role of acid-base site in the preparation of Al_2O_3-supported platinum catalysts.** Parkosh, S. (Alberta Research Council Edmonton); Chakrabartty, S.K.; Koanigawa, T. Alberta Research Council, Edmonton, AB (Canada). [1989]. (CE–02438). In *Alberta Research Council [research reports].* Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

The sorption of hexachloroplatinic acid on variously prepared specimens of alumina has been investigated under equilibrium and kinetic conditions. Relationships between metal dispersibility and sorption are interpreted in terms of interactions with superficial acid-base couple sites on the alumina substrates. 10 refs., 2 figs., 2 tabs.

36735 (BNL–42831) **Superexchange coupling mechanisms for electron transfer processes.** Newton, M.D. Brookhaven National Lab., Upton, NY (USA). 1989. 14p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8905146–1: 22. Jerusalem symposium on quantum chemistry, Jerusalem, Israel, 15-18 May 1989). Order Number DE89013568/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Electron transfer matrix elements for electron exchange between various pairs of transition metal complexes in close contact have been calculated and analyzed for a variety of approach geometries for the two reactants. The coupling between the nominal metal ion donor/acceptor sites is achieved by superexchange of the "hole" type arising from ligand-to-metal charge transfer (LMCT), the dominant ligand-field interaction for the electron-donor ligands considered (H_2O, NH_3, and the cyclopentadienide anion). The pronounced variations of H_{if} with geometry are not correlated with the separation distance of the metal ions (between which the direct overlap is negligible) and span the range from non-adiabatic to strongly adiabatic electronic coupling. The values for metallocene/metallocinium redox pairs bracket recently reported experimental values. Analysis of the results using the method of corresponding orbitals demonstrates the validity of an effective 1-electron model for the electron transfer process to within about 10% for the class of systems considered. A higher-order superexchange mechanism was encountered for the $Co(NH_3)_6^{2+/3+}$ exchange process, in which the LMCT-driven hole-transport mechanism couples excited local states of the metal ions, which in turn are connected to the corresponding ground states by spin-orbit mixing. This mechanism yields on electronic transmission factor within two orders of magnitude of unity. 30 refs., 5 tabs.

36736 (CONF-890792–1) **Infrared study of carbon deposits on catalysts.** Eischens, R.P. Lehigh Univ., Bethlehem, PA (USA). 1989. 9p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER13612. From Worldwide catalysis seminar: successful design of catalysts; Philadelphia, PA, USA; 5 Jul 1989. Order Number DE89013310/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The deposition of carbon on alumina and on catalysts, in which alumina was the support for platinum and rhenium, was followed by simultaneously weighing the total deposit and observing the infrared spectra. At total carbon deposit levels of 1 percent or less, produced by exposure to acetylene at 525 K or ethylene at 625 K, bands were observed near 1580 and 1470 cm^{-1}. Isotopic labeling with oxygen-18 and deuterium shows that these bands are attributable to the asymmetric and symmetric stretching vibrations of a carbon-oxygen species similar to a carboxylate ion. This species involves about one-sixth of the total carbon in deposits on alumina. Platinum does not markedly affect the total carbon or the fraction that is carboxylate. Rhenium does not affect the total carbon but it significantly lowers the carbon-oxygen species. Pretreatment of desulfurization catalysts with ammonia reduces the total carbon by about one-half and almost eliminates carboxylate formation. Carboxylates are not found in carbon deposits on silica. 15 refs., 5 figs.

36737 (DOE/ER/13411–4) **[Ligand intermediates in metalcatalyzed reactions]: Progress report, July 1, 1985–June 30, 1989.** Gladysz, J.A. Utah Univ., Salt Lake City, UT (USA). 1989. 24p. Sponsored by DOE Energy Research. DOE Contract FG02-85ER13411. Order Number DE89014683/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Synthesis, structure, and reactivity of the following complexes is discussed: CO_2/carboxylate complexes, vinylidene, formyl and acyl complexes, thioformaldehyde complexes, and organotransition metal hydride complexes. Also, redox properties of alkyl complexes, mechanisms of hydride abstraction from alkyl ligands, and activation of metal-bound methyl groups. Reaction intermediates for all of the above are discussed. 13 figs. (CBS)

36738 (DOE/ER/13564–7) **Chemistry of bimetallic linked cyclopentadienyl complexes: Progress report, 1 December 1986–30 November 1989.** Schrock, R.R. Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Chemistry. [1989]. 24p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER13564. Order Number DE89013965/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Research continued on the chemistry and preparation of bimetallic cyclopentadienyl complexes containing up to two tungsten or one tungsten and a cobalt, rhodium, or ruthenium. The general method for preparation and analysis of polyenes is also discussed. 7 figs., 2 tabs. (CBS)

36739 (DOE/ER/13582–T2) **Study of improved methods for predicting chemical equilibria: Composite technical progress report, July 1, 1986–June 30, 1989.** Lenz, T.G.; Vaughan, J.D. Colorado State Univ., Fort Collins, CO (USA). 1989. 62p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER13582. Order Number DE89014535/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Our research involves developing general computational methods for predicting the thermodynamic properties of condensed state chemically reactive systems. The overall effort has encompassed both computer studies, and parallel laboratory experimental work to support our evolving computational models. To date, we have demonstrated the soundness of molecular mechanics/force-field techniques for accurate prediction of the thermodynamic properties of chemically reactive systems. We have worked extensively with three molecular mechanics models, Boyd's MOLBD3, Allinger's MMP2 and the Warshel/Lifson/Karplus QCFF/PI program. No one of these programs at present has general full thermodynamic output capability. We are well on the way toward modifying QCFF/PI for such full thermodynamic capability. Our supporting laboratory studies have involved careful bomb calorimetry for ΔH_f^0 information, x-ray structure determination for accurate molecular geometry data, and kinetics/equilibrium determinations for various prototypical Diels-Alder reactions. Vapor pressure studies for candidate Diels-Alder compounds are also underway. The bomb calorimetric and greater initial effort on vapor pressure studies have replaced the original solvent effect and hindered rotation NMR studies planned, on the basis of most critical data needs for correct computational model development. 3 refs.

36740 (DOE/ER/13584–4) **[Dynamics of vibrationally excited polyatomic molecules and their unstable isomers on the electronic ground state potential surface]: Progress report.** Dai, Hai-Lung. Pennsylvania Univ., Philadelphia, PA (USA). Dept. of

Chemistry. 1989. 9p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER13584. Order Number DE89014682/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The general goal of this research is to understand the role of vibrational energy in chemical reactions related to energy production. Since the start of this grant in August 1986, we have made several advancements, both in the development of methodology and in science, toward understanding the chemical properties of highly vibrationally excited molecules. A transient vibrational spectroscopic method – Flash Photolysis Stimulated Emission Pumping – for radical species has been developed. The vibration-rotation levels of a radical, generated by flash photolysis at a concentration $\gtrsim 10^{-4}$ Torr, and with a lifetime of $\gtrsim 10^{-8}$ sec, can be characterized with 0.04 cm^{-1} resolution over a wide energy range (up to 10^4 cm^{-1}). This method was first demonstrated on CH_2. Using Stark Level-Crossing Spectroscopy, we have shown that highly excited, single vibration-rotation quantum states of small polyatomics can be characterized with great detail. This can be done even though these levels are dissociative, have high densities, and are optically inaccessible. 17 refs., 2 figs., 4 tabs.

36741 (DOE/ER/13603--T1) **Study of intermediates from transition metal excited-state electron-transfer reactions: Progress report, August 1, 1986–December 31, 1988.** Hoffman, M.Z. Boston Univ., MA (USA). Dept. of Chemistry. 31 Dec 1988. 20p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER13603. Order Number DE89014694/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the period covered by this progress report, the examination of intermediates from transition metal excited-state electron-transfer reactions followed certain well-defined themes; the techniques of conventional and time-resolved spectrofluorimetry, continuous and pulsed laser flash photolysis, and continuous and pulse radiolysis were employed. Research involves Ru(II) complexes and Cr(III) complexes. 23 refs., 2 tabs.

36742 (DOE/ER/72027–T2) **Structure and reactivity of chemisorbed species and reaction intermediates: Progress report, December 1, 1984–November 30, 1985.** Madey, T.E.; Kelley, R.D. National Bureau of Standards, Washington, DC (USA). Surface Science Div. 1 Aug 1985. 9p. Sponsored by DOE Energy Research. DOE Contract AT01-77ER72027. Order Number DE89014113/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The areas of work have supported a common theme: the structure and reactivity of chemisorbed species and reaction intermediate of importance to catalysis. A variety of tools have been to study the structure and chemistry of surface species, and to develop models and concepts of broad utility in chemisorption and catalysis. Adsorption of carbon monoxide, ammonia, hydrogen, and sulfur are discussed. Results of the research conducted or completed in the last year, as well as plans for the coming year, are summarized in this report. The results will be presented in three sections: (a) Surface Molecular Structure and Reactivity as Studied Using Electron Simulated Desorption Ion Angular Distribution (ESDIAD) and High Resolution Electron Energy Loss Spectroscopy (HREELS); (b) Neutron Inelastic Scattering Studies of Adsorption and Reaction on Catalysts; and (c) Reaction Kinetics at High Pressures over Single Crystal Catalysts.

36743 (ETDE-mf–9788064) **Mass spectrometry for investigations into the system lead/oxygen, using the electrochemical Knudsen cell.** Richthofen, A. von. Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen. 14 Jul 1987. 79p. (In German). Order Number DE89788064/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

In this study, the combination of an electrochemical Knudsen cell (EKC) with a quadrupole mass spectrometer (QMS) was successfully used for the first time to determine the thermodynamics of the yellow lead oxide vapour which has a complex composition. The following species could clearly be detected in the vapour of yellow lead oxide: PbO, Pb_2O_2, Pb_3O_3, Pb_4O_4, Pb_5O_5. In particular, Pb_3O_3 was detected in the vapour of yellow lead oxide in spite of the high potential of 12.4 eV required for its occurrence.

36744 (INIS-mf–11457(v.1,2) v. 1) **Experimental verification of the theory of clusters.** Hawrynski, M.J. (Inst. of Occupational Medicine, Lodz (Poland)). Canadian Nuclear Association, Toronto, ON (Canada). 1985. (CONF-841016–: International conference on occupational radiation safety in mining, Toronto, Ontario, Canada, 15-18 Oct 1984). In *Occupational radiation safety in mining. Proceedings of the international conference (in two volumes).* Order Number DE89619926/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Experimental verification of the theory of clusters is described in this paper. The measurements of diffusion coefficient of charged RnDP fraction in various relative humidities of air were done. Dynamic theory of clusters has been proved, whereas the static theory has not.

36745 (INIS-SU–89, pp. 3) **Synthesis and structure of mixed by cation ternary vanadates $Me_2MeLn(VO_4)_2$.** Komissarova, L.N. (Moskovskij Gosudarstvennyj Univ., Moscow (USSR)); Mel'nikov, P.P.; Carillo Heredero, J.D. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/chemical preparation; ALKALI METAL COMPOUNDS/crystal structure; RARE EARTH COMPOUNDS/chemical preparation; RARE EARTH COMPOUNDS/crystal structure; VANADATES/chemical preparation; VANADATES/crystal structure; CHEMICAL COMPOSITION; COMPARATIVE EVALUATIONS; MONOCRYSTALS; POLYCRYSTALS; VANADATES

36746 (INIS-SU–89, pp. 3-4) **Electric conductivity of ternary phosphates and vanadates of alkali and rare earth metals.** Mel'nikov, P.P. (Moskovskij Gosudarstvennyj Univ., Moscow (USSR)); Komissarova, L.N.; Karril'o Ehredero, Kh.D. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/electric conductivity; ALKALI METAL COMPOUNDS/permittivity; RARE EARTH COMPOUNDS/electric conductivity; RARE EARTH COMPOUNDS/permittivity; VANADATES/electric conductivity; VANADATES/permittivity; PERMITTIVITY; CHEMICAL COMPOSITION; CHEMICAL PREPARATION; PHOSPHATES; VANADATES

36747 (INIS-SU–89, pp. 4-5) **Phase diagram of the system $RbPO_3$-V_2O_5.** Mardirosova, I.V. (Rostovskij-na-Donu Inzhenerno-Stroitel'nyj Inst., Rostov-na-Donu (USSR)); Kosobokova, N.S.; Bukhalova, G.A.; Savenkova, M.A. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

RUBIDIUM PHOSPHATES/phase diagrams; VANADIUM OXIDES/phase diagrams; CHEMICAL COMPOSITION; CHEMICAL REACTIONS; DENSITY; EUTECTICS; GLASS; MELTING POINTS; REFRACTIVITY

36748 (INIS-SU–89, pp. 5) **On the compounds of rubidium, cesium and lanthanum polyphosphates.** Bukhalova, G.A. (Rostovskij-na-Donu Inzhenerno-Stroitel'nyj Inst., Rostov-na-Donu (USSR)); Mardirosova, I.V.; Litvinova, G.N.; Matrosova, V.A. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM PHOSPHATES/chemical preparation; LANTHANUM PHOSPHATES/chemical preparation; CHEMICAL COMPOSITION; GLASS; INFRARED SPECTRA; LATTICE PARAMETERS; MELTING POINTS; MOLECULAR STRUCTURE; RUBIDIUM PHOSPHATES

36749 (INIS-SU–89, pp. 6-7) **On the kinetics of dehydration of double orthophosphate hexahydrates $MgMPO_4$.** Lyutsko, V.A. (Belorusskij Gosudarstvennyj Univ., Minsk (Byelorussian SSR)); Frenkel', P.L. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM PHOSPHATES/chemical reaction kinetics; CESIUM PHOSPHATES/dehydration; MAGNESIUM PHOSPHATES/chemical reaction kinetics; MAGNESIUM PHOSPHATES/dehydration; ACTIVATION ENERGY; DEHYDRATION; CRYSTALLIZATION; HYDRATES

36750 (INIS-SU–89, pp. 7) **Lithium, rubidium, and cesium cyclohexaphosphates.** Borodina, L.A. (AN SSSR, Moscow (USSR). Inst. Obshchej i Neorganicheskoj Khimii); Chudinova, N.N.; Kholodkovskaya, L.N. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM PHOSPHATES/chemical preparation; CESIUM PHOSPHATES/dehydration; DEHYDRATION; CHEMICAL COMPOSITION; CRYSTAL STRUCTURE; CRYSTAL-PHASE TRANSFORMATIONS; HYDRATES; MONOCRYSTALS; SENSITIVITY; SPACE GROUPS; THERMAL DEGRADATION

36751 (INIS-SU–89, pp. 8) **Condensed phosphates of rare earth and rare alkali elements.** Masloboev, V.A. (AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya); Sazhenkov, A.Yu.; Krasilov, Yu.I. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/crystallization; ALKALI METAL COMPOUNDS/glass; RARE EARTH COMPOUNDS/crystallization; RARE EARTH COMPOUNDS/glass; ABSORPTION SPECTRA; CRYSTALLIZATION; GLASS; CHEMICAL COMPOSITION; CHEMICAL PREPARATION; CRYSTAL FIELD; ELECTRONIC STRUCTURE; HIGH TEMPERATURE; LUMINESCENCE; PHOSPHATES

36752 (INIS-SU–89, pp. 9-10) **Infrared absorption spectra of rare alkali metal phosphates.** Malashonok, I.E. (Belorusskij Tekhnologicheskij Inst., Minsk (Byelorussian SSR)); Mel'nikova, R.Ya.; Dzyuba, E.D.; Pechkovskij, V.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM PHOSPHATES/infrared spectra; ABSORPTION SPECTRA; CHEMICAL COMPOSITION

36753 (INIS-SU–89, pp. 10) **Determination of specific heats of double magnesium and alkali metal orthophosphates.** Frenkel', P.L. (Belorusskij Gosudarstvennyj Univ., Minsk (Byelorussian SSR)); Lyutsko, V.A. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM PHOSPHATES/specific heat; MAGNESIUM PHOSPHATES/specific heat; CALORIMETRY; HIGH TEMPERATURE; MEDIUM TEMPERATURE; TEMPERATURE DEPENDENCE

36754 (INIS-SU–89, pp. 12) **Properties of mixed polyphosphates of silver and rare alkali metals.** Savenkova, M.A.; Sogomonova, R.A.; Zheltkova, N.N. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM PHOSPHATES/molecular structure; CESIUM PHOSPHATES/phase diagrams; SILVER PHOSPHATES/molecular structure; SILVER PHOSPHATES/phase diagrams; CHEMICAL COMPOSITION; CHEMICAL REACTIONS; INFRARED SPECTRA; INORGANIC POLYMERS; MELTING POINTS

36755 (INIS-SU–89, pp. 13) **On the interaction of lithium and cesium phosphates of metaphosphate composition with bismuth metaphosphate.** Savenkova, M.A.; Faustova, R.S. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

BISMUTH PHOSPHATES/monoclinic lattices; BISMUTH PHOSPHATES/phase diagrams; CESIUM PHOSPHATES/monoclinic lattices; CESIUM PHOSPHATES/phase diagrams; ABSORPTION SPECTRA; CHEMICAL COMPOSITION; CHEMICAL REACTIONS; INFRARED SPECTRA; INORGANIC POLYMERS; LATTICE PARAMETERS; MOLECULAR STRUCTURE

36756 (INIS-SU–89, pp. 13-14) **Ternary phosphates $Ca_9LIR_23(PO_4)_7$ (R=rare earths, Y, Bi).** Lazoryak, V.I. (Moskovskij Gosudarstvennyj Univ., Moscow (USSR)); Golubev, V.N.; Vovk, E.A.; Aziev, R.G. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

RARE EARTH COMPOUNDS/chemical preparation; RARE EARTH COMPOUNDS/hexagonal lattices; YTTRIUM PHOSPHATES/chemical preparation; YTTRIUM PHOSPHATES/hexagonal lattices; CALCIUM PHOSPHATES; INFRARED SPECTRA; LATTICE PARAMETERS; LITHIUM PHOSPHATES; SPACE GROUPS

36757 (INIS-SU–89, pp. 14) **Thermodynamic and crystallochemical features of thermal dehydration process of rubidium and cesium dihydroorthophosphates.** Volkov, A.I. (Belorusskij Tekhnologicheskij Inst., Minsk (Byelorussian SSR)); Komshilova, O.N.; Fakeev, A.A.; Yaglov, V.N. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM PHOSPHATES/dehydration; CESIUM PHOSPHATES/monoclinic lattices; DEHYDRATION; CHEMICAL BONDS; CHEMICAL REACTION KINETICS; INTERATOMIC DISTANCES; MICROHARDNESS; PHOSPHORIC ACID

36758 (INIS-SU–89, pp. 15-16) **Synthesis and phase transformations of double chromates of cesium rubidium and potassium with lithium, M^+LICrO_4.** Klevtsov, P.V. (AN SSSR, Novosibirsk (USSR). Inst. Neorganicheskoj Khimii); Perepelitsa, A.P.; Ishchenko, V.N.; Klevtsova, R.F. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM COMPOUNDS/chemical preparation; CESIUM COMPOUNDS/crystal-phase transformations; CHEMICAL COMPOSITION; CHROMATES; CRYSTAL LATTICES; LATTICE PARAMETERS; LITHIUM COMPOUNDS; MELTING POINTS; MONOCRYSTALS; SPACE GROUPS

36759 (INIS-SU–89, pp. 16-17) **Double chromates of rubidium, cesium and rare earth elements.** Proskuryakova, E.V. (Moskovskij Inst. Tonkoj Khimicheskoj Tekhnologii, Moscow (USSR)); Politova, E.D.; Stefanovich, S.Yu.; Fomichev, V.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union*

conference on chemistry and technology of rare alkali elements. Summaries of reports. Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM COMPOUNDS/chemical preparation; CESIUM COMPOUNDS/phase studies; RARE EARTH COMPOUNDS/chemical preparation; RARE EARTH COMPOUNDS/phase studies; CHEMICAL COMPOSITION; CHROMATES; CRYSTAL STRUCTURE; CRYSTAL-PHASE TRANSFORMATIONS; PERMITTIVITY; PHASE DIAGRAMS; RUBIDIUM COMPOUNDS

36760 (INIS-SU–89, pp. 17-18) **Phase equilibria in the systems Li_2MoO_4-$BaMoO_4$-$Ln_2(MoO_4)_3$, Ln=La-Lu, Y. Luminescence of $Li_3Ba_2Ln_3(MoO_4)_8$-Nd^{3+}.** Korsun, V.P. (AN SSSR, Ulan-Ude (USSR). Inst. Estestvennykh Nauk); Kozhevnikova, N.M.; Mokhosoev, M.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

MOLYBDATES/monoclinic lattices; MOLYBDATES/phase diagrams; NEODYMIUM COMPOUNDS/luminescence; RARE EARTH COMPOUNDS/monoclinic lattices; RARE EARTH COMPOUNDS/phase diagrams; YTTRIUM COMPOUNDS/monoclinic lattices; YTTRIUM COMPOUNDS/phase diagrams; BARIUM COMPOUNDS; CHEMICAL REACTIONS; DOPED MATERIALS; EQUILIBRIUM; LITHIUM COMPOUNDS; MELTING POINTS; MOLYBDATES; LUMINESCENCE

36761 (INIS-SU–89, pp. 18-19) **Enthalpies of melting and polymorphic transformations of alkali metal molybdates, tungstates, and chromates.** Papikyan, S.Kh.; Suponitskij, Yu.L.; Zolotova, E.S.; Dyunin, A.G. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/fusion heat; ALKALI METAL COMPOUNDS/transition heat; MOLYBDATES/fusion heat; MOLYBDATES/transition heat; TUNGSTATES/fusion heat; TUNGSTATES/transition heat; CHEMICAL COMPOSITION; CHROMATES; CRYSTAL-PHASE TRANSFORMATIONS; MOLYBDATES; TUNGSTATES

36762 (INIS-SU–89, pp. 19-20) **Physicochemical study of interaction in the systems Li_2O-TeO_2-M_nO_m (M-Cr, Mo, Tl; n=1.2; m=2.3).** Safonov, V.V. (Moskovskij Inst. Tonkoj Khimicheskoj Tekhnologii, Moscow (USSR)). AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

MOLYBDENUM OXIDES/chemical reactions; MOLYBDENUM OXIDES/phase diagrams; TELLURIUM OXIDES/chemical reactions; TELLURIUM OXIDES/phase diagrams; CHROMIUM OXIDES; CRYSTAL LATTICES; CRYSTAL-PHASE TRANSFORMATIONS; ELECTRIC CONDUCTIVITY; GLASS; INFRARED SPECTRA; LATTICE PARAMETERS; LITHIUM OXIDES; TITANIUM OXIDES

36763 (INIS-SU–89, pp. 20-21) **Connection between structure of alkali metal molybdates and tungstates and their spectral and energetic characteristics.** Poloznikova, M.Eh. (Moskovskij Inst. Tonkoj Khimicheskoj Tekhnologii, Moscow (USSR)); Kondratov, O.I.; Fomichev, V.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/infrared spectra; ALKALI METAL COMPOUNDS/molecular structure; MOLYBDATES/infrared spectra; MOLYBDATES/molecular structure; TUNGSTATES/infrared spectra; TUNGSTATES/molecular structure; ATOMIC NUMBER; ATOMIZATION; CHEMICAL COMPOSITION; CORRELATIONS; DISSOCIATION HEAT; INTERATOMIC DISTANCES; MOLYBDATES; RAMAN SPECTRA; TUNGSTATES

36764 (INIS-SU–89, pp. 21-22) **Thermodynamic properties of alkali metal chalcogenates, chromates, molybdates, and tungstates.** Suponitskij, Yu.L. (Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR)). AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/formation free enthalpy; ALKALI METAL COMPOUNDS/formation heat; MOLYBDATES/formation free enthalpy; MOLYBDATES/formation heat; TUNGSTATES/formation free enthalpy; TUNGSTATES/formation heat; CHEMICAL COMPOSITION; CHROMATES; CORRELATIONS; ENTROPY; MOLYBDATES; SELENATES; SULFATES; TUNGSTATES

36765 (INIS-SU–89, pp. 22-23) **Synthesis and properties of double tungstates of rubidium, cesium, and titanium.** Batueva, I.S. (AN SSSR, Ulan-Ude (USSR). Inst. Estestvennykh Nauk); Bazarova, Zh.G.; Mokhosoev, M.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM TUNGSTATES/chemical preparation; CESIUM TUNGSTATES/crystal structure; RUBIDIUM TUNGSTATES/chemical preparation; RUBIDIUM TUNGSTATES/crystal structure; CHEMICAL COMPOSITION; HIGH TEMPERATURE; PERMITTIVITY; SENSITIVITY; THERMAL DEGRADATION; TITANIUM COMPOUNDS; VERY HIGH TEMPERATURE

36766 (INIS-SU–89, pp. 24) **Interaction of thallium (1) and lithium molybdates (tungstates).** Mokhosoev, M.V. (AN SSSR, Ulan-Ude (USSR). Inst. Estestvennykh Nauk); Arkhincheeva, S.I.; Bazarova, Zh.G.; Khazheeva, Z.I.; Munkueva, S.D. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

LITHIUM TUNGSTATES/chemical reactions; LITHIUM TUNGSTATES/phase diagrams; MOLYBDATES/chemical reactions; MOLYBDATES/phase diagrams; CHEMICAL COMPOSITION; CRYSTAL LATTICES; ELECTRIC CONDUCTIVITY; EUTECTICS; LATTICE PARAMETERS; MELTING POINTS; MOLYBDATES; PERMITTIVITY; SOLIDS; THALLIUM COMPOUNDS

36767 (INIS-SU–89, pp. 24-25) **Double sodium molybdates with rubidium and cesium.** Khajkina, E.G. (AN SSSR, Ulan-Ude (USSR). Inst. Estestvennykh Nauk); Khal'baeva, K.M.; Basovich, O.M. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM COMPOUNDS/chemical reactions; CESIUM COMPOUNDS/phase diagrams; MOLYBDATES/chemical reactions; MOLYBDATES/phase diagrams; CRYSTAL STRUCTURE; CRYSTAL-PHASE TRANSFORMATIONS; DEHYDRATION; EUTECTICS; LATTICE PARAMETERS; MOLYBDATES; MONOCRYSTALS; RUBIDIUM COMPOUNDS; SODIUM COMPOUNDS; SOLID SOLUTIONS

36768 (INIS-SU–89, pp. 26) **Study of physicochemical properties of alkali metal salts of 12-tungstogallic acid.** Maksimova, L.G. (AN SSSR, Sverdlovsk (USSR). Inst. Khimii); Denisova, T.A.; Volkov, V.L. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/chemical preparation; ALKALI METAL COMPOUNDS/pyrolysis; GALLIUM COMPOUNDS/chemical preparation; GALLIUM COMPOUNDS/pyrolysis; TUNGSTEN COMPOUNDS/chemical preparation; TUNGSTEN COMPOUNDS/pyrolysis; ACTIVATION ENERGY; PYROLYSIS; CHEMICAL COMPOSITION; CHEMICAL REACTION KINETICS; DEHYDRATION; ELECTRIC CONDUCTIVITY; HETEROPOLYANIONS; HYDRATES; INORGANIC ACIDS; OXYGEN COMPOUNDS

36769 (INIS-SU–89, pp. 26-27) **Physicochemical features of Li_2MoO_4 and Li_2WO_4 behaviour under different methods of treatment.** Kurilenko, L.I. (AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii); Saunin, E.I.; Serebryakova, N.V.; Gromov, V.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

LITHIUM TUNGSTATES/chemical radiation effects; LITHIUM TUNGSTATES/chemical reactions; MOLYBDATES/chemical radiation effects; MOLYBDATES/chemical reactions; ANNEALING; CRYSTAL LATTICES; IONIZING RADIATIONS; MOLYBDATES; PHASE STUDIES; POLYCRYSTALS; RADIATION DOSES

36770 (INIS-SU–89, pp. 28) **Systems MVO_3-$Zn(VO_3)_2$ and MVO_3-$Mn(VO_3)_2$, where M=Li, Rb, Cs.** Slobodin, B.V. (AN SSSR, Sverdlovsk (USSR). Inst. Khimii). AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/chemical reactions; ALKALI METAL COMPOUNDS/phase diagrams; MANGANESE COMPOUNDS/chemical reactions; MANGANESE COMPOUNDS/phase diagrams; VANADATES/chemical reactions; VANADATES/phase diagrams; ZINC COMPOUNDS/chemical reactions; ZINC COMPOUNDS/phase diagrams; CHEMICAL COMPOSITION; EUTECTICS; PHASE STUDIES; QUANTITY RATIO; VANADATES

36771 (INIS-SU–89, pp. 29) **Mass spectrometric study of evaporation of rubidium and cesium vanadates.** Semenov, G.A. (Leningradskij Gosudarstvennyj Univ., Leningrad (USSR)); Kozyukova, N.V.; Slobodin, B.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM COMPOUNDS/evaporation; CESIUM COMPOUNDS/sublimation heat; VANADATES/evaporation; VANADATES/sublimation heat; EVAPORATION; FORMATION HEAT; MASS SPECTRA; RUBIDIUM COMPOUNDS; VANADATES; VERY HIGH TEMPERATURE

36772 (INIS-SU–89, pp. 30-31) **Thermogravimetric study of formation process and properties of cesium tantalum oxides.** Semrad, E.E. (Uzhgorodskij Gosudarstvennyj Univ., Uzhgorod (Ukrainian SSR)); Kovach, S.K.; Feesh, A.A.; Voroshilov, Yu.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM OXIDES/chemical preparation; TANTALUM OXIDES/chemical preparation; CHEMICAL COMPOSITION; MELTING POINTS; QUANTITY RATIO; VERY HIGH TEMPERATURE

36773 (INIS-SU–89, pp. 31) **Kinetics of lithium niobate interaction with molten ammonium hydrodifluoride.** Melkumyants, M.V. (Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR)); Fedorov, A.E.; Naumov, Yu.Yu.; Bystrova, N.M.; Grechko, N.Yu.; Rakov, Eh.G. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

NIOBATES/chemical reaction kinetics; NIOBATES/dissolution; ACTIVATION ENERGY; AMMONIUM FLUORIDES; HIGH TEMPERATURE; HYDROFLUORIC ACID; LITHIUM COMPOUNDS; MOLTEN SALTS; MONOCRYSTALS; NIOBATES; DISSOLUTION

36774 (INIS-SU–89, pp. 31-33) **Lithium dodecavanadates with mixed oxidation degree of vanadium.** Ivakin, A.A. (AN SSSR, Sverdlovsk (USSR). Inst. Khimii); Kruchinina, M.V.; Koryakova, O.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

VANADATES/phase studies; VANADATES/valence; CHEMICAL COMPOSITION; CHEMICAL PREPARATION; INFRARED SPECTRA; ION EXCHANGE; LAYERS; LITHIUM COMPOUNDS; MOLECULAR STRUCTURE; VANADATES; VALENCE

36775 (INIS-SU–89, pp. 33) **Vibrational spectra and structure of vanadates $M_2Zn(VO_3)_4$, where M-Rb, Cs.** Kristallov, L.V. (AN SSSR, Sverdlovsk (USSR). Inst. Khimii); Perelyaeva, L.A.; Slobodin, B.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM COMPOUNDS/infrared spectra; CESIUM COMPOUNDS/molecular structure; VANADATES/infrared spectra; VANADATES/molecular structure; CHEMICAL COMPOSITION; POLYCRYSTALS; RAMAN SPECTRA; RUBIDIUM COMPOUNDS; VANADATES; VIBRATIONAL STATES; ZINC COMPOUNDS

36776 (INIS-SU–89, pp. 34-35) **Features of solid-phase interaction between lithium carbonate and niobium pentoxide hydrate.** Belov, V.V. (Moskovskij Inst. Radiotekhniki, Ehlektroniki i Avtomatiki, Moscow (USSR)); Shapiro, Z.I.; Velikodnyj, Yu.A.; Marugin, V.V.; Allakhverdov, G.R. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

NIOBIUM OXIDES/chemical reactions; CHEMICAL REACTION KINETICS; HIGH TEMPERATURE; HYDRATES; LITHIUM CARBONATES; MEDIUM TEMPERATURE; POWDERS

36777 (INIS-SU–89, pp. 35) **Phase composition in the system $LiVO_3$-TiO_2-V_2O_5(V_2O_4).** Golovkin, B.G. (AN SSSR, Sverdlovsk (USSR). Inst. Khimii); Volkov, V.L. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

VANADATES/phase diagrams; VANADIUM OXIDES/phase diagrams; AIR; CHEMICAL REACTIONS; HIGH TEMPERATURE; LITHIUM COMPOUNDS; PHASE STUDIES; SOLID SOLUTIONS; TITANIUM OXIDES; VANADATES

36778 (INIS-SU–89, pp. 36) **Effect of cesium ions on character of solubility and rare earth formate complexing processes.** Akhmatova, Zh.T. (AN SSSR, Moscow (USSR). Inst. Obshchej i Neorganicheskoj Khimii); Portnova, S.M. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM COMPOUNDS/phase diagrams; CESIUM COMPOUNDS/solubility; EUROPIUM COMPLEXES/chemical preparation; EUROPIUM COMPOUNDS/phase diagrams; EUROPIUM COMPOUNDS/solubility; TERBIUM COMPLEXES/chemical preparation; TERBIUM COMPOUNDS/phase diagrams; TERBIUM

COMPOUNDS/solubility; AQUEOUS SOLUTIONS; SOLUBILITY; CRYSTALLIZATION; FORMATES; MEDIUM TEMPERATURE; QUANTITY RATIO

36779 (INIS-SU–89, pp. 36-37) **Interaction of lithium chlorides, nitrates, sulfates with rare earths and hexamethylenetramine in aqueous solutions at 25-100 deg C.** Shevchuk, V.G. (Poltavskij Inzhenerno-Stroitel'nyj Inst., Poltava (Ukrainian SSR)); Ivanitskaya, I.A.; Bunyakina, N.V.; Storozhenko, D.A.; Omelyan, V.I.; Shiraj, Yu.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

RARE EARTH COMPOUNDS/chemical reactions; RARE EARTH COMPOUNDS/solubility; AMINES; AQUEOUS SOLUTIONS; CRYSTALLIZATION; LITHIUM CHLORIDES; LITHIUM NITRATES; LITHIUM SULFATES; MEDIUM TEMPERATURE; PHASE DIAGRAMS; PHASE STUDIES; SOLUBILITY

36780 (INIS-SU–89, pp. 37) **Interaction of cesium, nickel and praseodymium (3) sulfates in aqueous solutions.** Shevchuk, V.G. (Poltavskij Inzhenerno-Stroitel'nyj Inst., Poltava (Ukrainian SSR)); Onishchenko, M.K.; Skorikov, V.M.; Vajsfel'd, M.I. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM SULFATES/phase diagrams; CESIUM SULFATES/solubility; PRASEODYMIUM SULFATES/phase diagrams; PRASEODYMIUM SULFATES/solubility; AQUEOUS SOLUTIONS; SOLUBILITY; CHEMICAL COMPOSITION; CHEMICAL REACTIONS; CRYSTALLIZATION; MEDIUM TEMPERATURE; NICKEL SULFATES

36781 (INIS-SU–89, pp. 38) **Formation conditions and some properties of double nitrates of rare alkali metals and rare earths.** Shevchuk, V.G. (Poltavskij Inzhenerno-Stroitel'nyj Inst., Poltava (Ukrainian SSR)); Dryuchko, A.G.; Vigdorchik, A.G.; Omelyan, V.I.; Lazorenko, N.M.; Kisel', N.N. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/chemical preparation; ALKALI METAL COMPOUNDS/phase diagrams; RARE EARTH COMPOUNDS/chemical preparation; RARE EARTH COMPOUNDS/phase diagrams; YTTRIUM NITRATES/chemical preparation; YTTRIUM NITRATES/phase diagrams; AQUEOUS SOLUTIONS; CHEMICAL COMPOSITION; CRYSTALLIZATION; MEDIUM TEMPERATURE; MOLECULAR STRUCTURE; MONOCRYSTALS; PHASE STUDIES

36782 (INIS-SU–89, pp. 38-39) **Synthesis and physicochemical study of double chlorides, nitrates, sulfates of rubidium and cesium with calcium, lanthanum, neodymium, ytterbium.** Storozhenko, D.A. (Poltavskij Inzhenerno-Stroitel'nyj Inst., Poltava (Ukrainian SSR)); Ivanitskaya, I.A.; Bunyakina, N.V.; Shiraj, Yu.V.; Omelyan, V.I. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/crystallization; ALKALI METAL COMPOUNDS/phase diagrams; RARE EARTH COMPOUNDS/crystallization; RARE EARTH COMPOUNDS/phase diagrams; CRYSTALLIZATION; AQUEOUS SOLUTIONS; CALCIUM CHLORIDES; CHEMICAL COMPOSITION; CHEMICAL PREPARATION; GLYCOLS; HYDRATES; MEDIUM TEMPERATURE; MONOCRYSTALS; NITRATES; PHYSICAL PROPERTIES; SULFATES

36783 (INIS-SU–89, pp. 39-40) **Interaction of ammonium fluoroyttrates with lithium salts.** Mel'nichenko, E.I. (AN SSSR, Vladivostok (USSR). Inst. Khimii); Kalacheva, T.A.; Polishchuk, S.A. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

YTTRIUM FLUORIDES/chemical reactions; AMMONIUM FLUORIDES; CHEMICAL REACTION KINETICS; HIGH TEMPERATURE; LITHIUM CHLORIDES

36784 (INIS-SU–89, pp. 40-41) **Study of the system LiC_2H_5COO-$Y(C_2H_5COO)_3$-H_2O at 25 deg C.** Nadzharyan, K.A. (AN SSSR, Novosibirsk (USSR). Inst. Khimii Tverdogo Tela i Pererabotki Mineral'nogo Syr'ya). AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

YTTRIUM COMPOUNDS/phase diagrams; YTTRIUM COMPOUNDS/solubility; AQUEOUS SOLUTIONS; CARBOXYLIC ACID SALTS; CRYSTALLIZATION; LITHIUM COMPOUNDS; MEDIUM TEMPERATURE; PROPIONIC ACID; TRANSITION TEMPERATURE; SOLUBILITY

36785 (INIS-SU–89, pp. 52-53) **Low-melting alloys of halide and nitrate systems of alkali and alkaline earth metals and their practical use.** Il'yasov, I.I. (Zaochnyj Inst. Sovetskoj Torgovli, Rostov-na-Donu (USSR)). AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/melting points; ALKALI METAL COMPOUNDS/phase diagrams; ALKALINE EARTH METAL COMPOUNDS/melting points; ALKALINE EARTH METAL COMPOUNDS/phase diagrams; CADMIUM NITRATES/melting points; CADMIUM NITRATES/phase diagrams; CHEMICAL REACTIONS; EUTECTICS; HALIDES; HIGH TEMPERATURE; LEAD COMPOUNDS; MOLTEN SALTS; SOLID SOLUTIONS; THALLIUM COMPOUNDS; USES

36786 (INIS-SU–89, pp. 45-46) **Synthesis and physicochemical properties of ammonium-containing fluoroaluminates of rare alkali elements.** Baldova, M.V.; Morozov, V.G.; Nikitina, S.D.; Shchegoleva, R.I.; Rys'kin, M.P.; Popova, R.A.; Mikhajlova, N.L. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM COMPOUNDS/chemical preparation; ALUMINIUM COMPLEXES; AMMONIUM COMPOUNDS; CHEMICAL COMPOSITION; CHEMICAL PROPERTIES; COORDINATION NUMBER; FLUORIDES; PHYSICAL PROPERTIES

36787 (INIS-SU–89, pp. 48-49) **Thermographic and X-ray diffraction study of binary systems based on rare alkali metal and thallium (1) nitrates and conditions of solid solution formation in them.** Akopov, E.K. (Krasnodarskij Politekhnicheskij Inst., Krasnodar (USSR)); Panieva, L.A. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM NITRATES/phase diagrams; CESIUM NITRATES/solid solutions; THALLIUM NITRATES/phase diagrams; THALLIUM NITRATES/solid solutions; CRYSTAL LATTICES; CRYSTAL-PHASE TRANSFORMATIONS; DENSITY; LATTICE PARAMETERS; PHASE STUDIES

36788 (INIS-SU–89, pp. 50) **Four-component system of lithium, cesium, potassium, calcium bromides.** Bukhalova, G.A. (Rostovskij-na-Donu Inzhenerno-Stroitel'nyj Inst., Rostov-na-Donu (USSR)); Litvinova, G.N.; Savenkov, I.S. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya.

1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM BROMIDES/molten salts; CESIUM BROMIDES/phase diagrams; CALCIUM BROMIDES; ELECTROLYTES; EUTECTICS; LITHIUM BROMIDES; MELTING POINTS; POTASSIUM BROMIDES; QUANTITY RATIO

36789 (INIS-SU–89, pp. 49-50) **Synthesis and study of some properties of mixed hexacyanoferrates (3) of rare alkali and alkaline-earth elements.** Slivko, T.A. (Moskovskij Inst. Tonkoj Khimicheskoj Tekhnologii, Moscow (USSR)); Zimina, G.V.; Fomichev, V.V.; Kuligina, T.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM COMPOUNDS/chemical preparation; CESIUM COMPOUNDS/pyrolysis; STRONTIUM COMPOUNDS/chemical preparation; STRONTIUM COMPOUNDS/pyrolysis; PYROLYSIS; CHEMICAL BONDS; CHEMICAL COMPOSITION; CRYSTAL STRUCTURE; DEHYDRATION; FERRICYANIDES; HYDRATES; SOLUBILITY

36790 (INIS-SU–89, pp. 53) **Lithium beryllates and their thermodynamic properties.** Kuranov, K.E. (AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii); Atanov, A.I.; Saunin, E.I.; Gromov, V.V.; Zakharov, M.A. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

BERYLLIUM OXIDES/phase diagrams; BERYLLIUM OXIDES/vapor pressure; LITHIUM OXIDES/phase diagrams; LITHIUM OXIDES/vapor pressure; CHEMICAL COMPOSITION; EUTECTICS; EVAPORATION; MELTING POINTS; QUANTITY RATIO; VAPORIZATION HEAT

36791 (INIS-SU–89, pp. 54-55) **Study of interaction in ternary bromide systems of lithium, sodium, rubidium, cesium, cadmium, barium, calcium, and lead.** Il'yasov, I.I. (Zaochnyj Inst. Sovetskoj Torgovli, Rostov-na-Donu (USSR)); Dunaeva, T.I.; Barsegov, D.G.; Lepeshkov, I.N. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/chemical reactions; ALKALI METAL COMPOUNDS/phase diagrams; ALKALINE EARTH METAL COMPOUNDS/chemical reactions; ALKALINE EARTH METAL COMPOUNDS/phase diagrams; CADMIUM BROMIDES/chemical reactions; CADMIUM BROMIDES/phase diagrams; CHEMICAL COMPOSITION; CRYSTALLIZATION; EUTECTICS; HIGH TEMPERATURE; SOLID SOLUTIONS

36792 (INIS-SU–89, pp. 55) **Complexing in ternary chloride systems of alkali metals and lead.** Il'yasov, I.I. (Zaochnyj Inst. Sovetskoj Torgovli, Rostov-na-Donu (USSR)); Dunaeva, T.I. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CADMIUM CHLORIDES/chemical reactions; CADMIUM CHLORIDES/phase diagrams; CESIUM CHLORIDES/chemical reactions; CESIUM CHLORIDES/phase diagrams; LITHIUM CHLORIDES/chemical reactions; LITHIUM CHLORIDES/phase diagrams; CADMIUM COMPLEXES; CHEMICAL COMPOSITION; CRYSTALLIZATION; EUTECTICS; MELTING POINTS

36793 (INIS-SU–89, pp. 56) **Solubility of solid phases of the system $CsBr$-$HgBr_2$-H_2O at 50 and 75 deg C.** Azarova, L.A. (AN SSSR, Moscow (USSR). Inst. Obshchej i Neorganicheskoj Khimii); Kravchuk, K.G. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM BROMIDES/phase diagrams; CESIUM BROMIDES/solubility; MERCURY BROMIDES/phase diagrams; MERCURY BROMIDES/solubility; AQUEOUS SOLUTIONS; SOLUBILITY; CRYSTALLIZATION; MEDIUM TEMPERATURE; TEMPERATURE DEPENDENCE

36794 (INIS-SU–89, pp. 57-58) **On the interaction of cesium nitrate with zinc nitrate in saturated aqueous solution at 298 K.** Tsirikhova, N.Kh. (Severo-Osetinskij Gosudarstvennyj Univ., Ordzhonikidze (USSR)); Khutsistova, F.M.; Kaloev, N.I. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM NITRATES/phase diagrams; CESIUM NITRATES/solubility; AQUEOUS SOLUTIONS; SOLUBILITY; CRYSTALLIZATION; DENSITY; ELECTRIC CONDUCTIVITY; EQUILIBRIUM; MEDIUM TEMPERATURE; SATURATION; VISCOSITY; ZINC NITRATES

36795 (INIS-SU–89, pp. 58-59) **Regularities of structure and properties of mixed oxides of the composition $ABTeO_6$ (A-K, Rb, Cs, Tl; B-Nb, Ta, Sb).** Egorov, N.P. (Gor'kovskij Gosudarstvennyj Univ., Gorki (USSR)); Chernorukov, N.G.; Korshunov, I.A.; Sulejmanov, E.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/crystal structure; ALKALI METAL COMPOUNDS/ion exchange; NIOBIUM OXIDES/crystal structure; NIOBIUM OXIDES/ion exchange; TANTALUM OXIDES/crystal structure; TANTALUM OXIDES/ion exchange; TELLURIUM OXIDES/crystal structure; TELLURIUM OXIDES/ion exchange; ANTIMONY OXIDES; CHEMICAL COMPOSITION; CHEMICAL PREPARATION; LATTICE PARAMETERS; PYROLYSIS; PYROLYSIS PRODUCTS; SOLID ELECTROLYTES; THALLIUM OXIDES

36796 (INIS-SU–89, pp. 59) **Physicochemical study of the systems BiI_3-M^1I (M^1-Li, Na, K, Rb, Cs) and properties of forming compounds.** Kaloev, N.I. (Gor'kovskij Gosudarstvennyj Univ., Gorki (USSR)); Bukhalova, G.A.; Dzeranova, K.B. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/chemical reactions; ALKALI METAL COMPOUNDS/phase diagrams; BISMUTH IODIDES/chemical reactions; BISMUTH IODIDES/phase diagrams; BISMUTH COMPLEXES; CHEMICAL COMPOSITION; PHYSICAL PROPERTIES

36797 (INIS-SU–89, pp. 60) **Fusion phase diagram of the system BiI_3-KI.** Dzeranova, K.B. (Severo-Osetinskij Gosudarstvennyj Univ., Ordzhonikidze (USSR)); Bukhalova, G.A.; Kaloev, N.I.; Mardirosova, I.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

BISMUTH IODIDES/chemical reactions; BISMUTH IODIDES/phase diagrams; POTASSIUM IODIDES/chemical reactions; POTASSIUM IODIDES/phase diagrams; CHEMICAL COMPOSITION; EUTECTICS; MELTING POINTS; PHYSICAL PROPERTIES

36798 (INIS-SU–89, pp. 60-61) **Solubility diagrams of the systems Li_2SO_4-Na_2SO_4-$MeSO_4$-H_2O (Me-Mg, Mn, Co, Ni, Cu, Zn, Cd) at 25 deg C.** Nokhrin, V.I. (Leningradskij Gosudarstvennyj Univ., Leningrad (USSR)); Filippov, V.K. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CADMIUM SULFATES/phase diagrams; CADMIUM SULFATES/solubility; AQUEOUS SOLUTIONS; SOLUBILITY; CRYSTALLIZATION; LITHIUM SULFATES; MEDIUM TEMPERATURE; SODIUM SULFATES; THERMODYNAMIC ACTIVITY

36799 (INIS-SU–89, pp. 62) **Sulfates of rare alkali metals.** Kovalev, A.E. (Poltavskij Inzhenerno-Stroitel'nyj Inst., Poltava (Ukrainian SSR)); Shevchuk, A.V.; Sakhno, T.V. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/chemical preparation; ALKALI METAL COMPOUNDS/phase diagrams; AMMONIUM SULFATES; AQUEOUS SOLUTIONS; CHEMICAL COMPOSITION; CRYSTALLIZATION; HYDRATES; MAGNESIUM SULFATES; MEDIUM TEMPERATURE; SOLUBILITY

36800 (INIS-SU–89, pp. 62-63) **Solubility of sulfates and oxalates of alkaline earth metals in aqueous solutions of alkali metal salts.** Kopyrin, A.A. (Leningradskij Tekhnologicheskij Inst., Leningrad (USSR)); Pyartman, A.K.; Keskinov, V.A. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

ALKALI METAL COMPOUNDS/phase diagrams; ALKALINE EARTH METAL COMPOUNDS/phase diagrams; ALKALINE EARTH METAL COMPOUNDS/solubility; SOLUBILITY; AQUEOUS SOLUTIONS; MEDIUM TEMPERATURE; OXALATES; QUANTITY RATIO; SULFATES

36801 (INIS-SU–89, pp. 63) **Phase ratios in the system Li_2O-K_2O-NiO-V_2O_5.** Surat, L.L. (AN SSSR, Sverdlovsk (USSR). Inst. Khimii); Fotiev, A.A. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

VANADIUM OXIDES/chemical reactions; VANADIUM OXIDES/phase diagrams; CHEMICAL COMPOSITION; LITHIUM OXIDES; NICKEL OXIDES; PHASE STUDIES; POTASSIUM OXIDES

36802 (INIS-SU–89, pp. 64) **NMR study of interactions of rare alkali metal ions (Li^+ and Cs^+) with Co^{2+} and Ni^{2+} in aqueous solutions.** Mazitov, R.K. (AN SSSR, Moscow (USSR). Inst. Obshchej i Neorganicheskoj Khimii); Borina, A.F.; Gejst, A.G. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM COMPOUNDS/chemical reactions; AQUEOUS SOLUTIONS; CESIUM 133; COBALT CHLORIDES; NICKEL CHLORIDES; NMR SPECTRA; QUANTITY RATIO

36803 (INIS-SU–89, pp. 115-116) **Conversion methods for complex fluorides of rare alkali elements.** Morozov, V.G. (AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya); Shchegoleva, R.I.; Nikitina, S.D.; Baldova, M.V.; Rys'kina, M.P. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM FLUORIDES/chemical reactions; ALUMINIUM FLUORIDES; AQUEOUS SOLUTIONS; CHEMICAL COMPOSITION; QUANTITY RATIO; SILICON FLUORIDES

36804 (INIS-SU–89, pp. 117) **Technology of preparation of cesium chloride and iodine from CsI(Tl) monocrystal wastes.** Banik, V.V.; Cherginets, V.L.; Krivko, I.P.; Sherblyuk, E.N. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM CHLORIDES/production; IODINE/production; PRODUCTION; CESIUM IODIDES; EFFICIENCY; INDUSTRIAL WASTES; IODINE; MONOCRYSTALS; THALLIUM COMPOUNDS; WASTE PRODUCT UTILIZATION

36805 (INIS-SU–89, pp. 118-119) **State of and trends in development of production of pure and high-pure compounds of lithium, rubidium and cesium.** Ryabenko, E.A. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Khimicheskikh Reaktivov i Osobo Chistykh Veshchestv, Moscow (USSR)); Fakeev, A.A.; Kuznetsova, Yu.S.; Allakhverdov, G.R. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM COMPOUNDS/production; CESIUM COMPOUNDS/purification; PRODUCTION; PURIFICATION; FLOWSHEETS; IMPURITIES

36806 (INIS-SU–89, pp. 119-120) **Preparation of cesium iodide of high purity for low-background monocrystals.** Arkhipov, S.M. (Moskovskij Inst. Tonkoj Khimicheskoj Tekhnologii, Moscow (USSR)); Poletaev, I.F.; Lyudomirskaya, A.P.; Zimina, G.V.; Slivko, T.A. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM IODIDES/crystallization; CESIUM IODIDES/purification; AQUEOUS SOLUTIONS; CRYSTALLIZATION; PURIFICATION; IMPURITIES; MONOCRYSTALS; POTASSIUM COMPOUNDS; RUBIDIUM COMPOUNDS; TRACE AMOUNTS

36807 (INIS-SU–89, pp. 120) **Preparation of cesium iodide of high purity.** Banik, V.V.; Blank, A.B.; Smirnova, O.M. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM IODIDES/crystallization; CESIUM IODIDES/purification; AQUEOUS SOLUTIONS; CRYSTALLIZATION; PURIFICATION; EUTECTICS; IMPURITIES; MONOCRYSTALS; TRACE AMOUNTS

36808 (INIS-SU–89, pp. 120-121) **Granulation from melt of cesium iodide base compositions.** Banik, V.V.; Alisejchik, V.V.; Kurochka, V.E. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM IODIDES/granular materials; CESIUM IODIDES/pelletizing; ARGON; PELLETIZING; LABORATORY EQUIPMENT; PARTICLE SIZE; SCINTILLATION COUNTERS; SODIUM COMPOUNDS; THALLIUM COMPOUNDS; USES

36809 (INIS-SU–89, pp. 157-158) **Polymorphic transitions in $LiIO_3$ crystals.** Zakharov, N.A. (AN SSSR, Moscow (USSR). Inst. Obshchej i Neorganicheskoj Khimii); Egorov, A.V.; Kozlova, N.S.; Portnov, O.G.; Orlovskij, V.P.; Mergelyan, O.S. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on*

chemistry and technology of rare alkali elements. Summaries of reports. Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

IODATES/crystal-phase transformations; LITHIUM COMPOUNDS/crystal-phase transformations; HIGH TEMPERATURE; IODATES; MONOCRYSTALS; PERMITTIVITY; PIEZOELECTRICITY; TEMPERATURE DEPENDENCE

36810 (INIS-SU–89, pp. 160-161) **Synthesis and analysis of high-pure lithium iodate monocrystals.** Nadzharyan, K.A. (AN Ukrainskoj SSR, Odessa (Ukrainian SSR). Fiziko-Khimicheskij Inst.); Stajkov, A.I.; Mishchenko, V.T.; Shcherbakova, T.M.; Magunov, R.L. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

IODATES/crystal growth; IODATES/quantitative chemical analysis; LITHIUM COMPOUNDS/crystal growth; LITHIUM COMPOUNDS/quantitative chemical analysis; ACCURACY; HEXAGONAL LATTICES; IMPURITIES; IODATES; MONOCRYSTALS; SENSITIVITY; TRANSITION ELEMENT COMPOUNDS

36811 (INIS-SU–89, pp. 126) **Investigation into deep purification processes of potassium, rubidium and cesium dihydrophosphates.** Fakeev, A.A. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Khimicheskikh Reaktivov i Osobo Chistykh Veshchestv, Moscow (USSR)); Gudintseva, Eh.N.; Kuemanguzhina, L.K.; Sukhanovskaya, A.I. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM PHOSPHATES/purification; ALUMINIUM PHOSPHATES; AQUEOUS SOLUTIONS; PURIFICATION; COPRECIPITATION; IMPURITIES; ION EXCHANGE; MEDIUM TEMPERATURE; PHASE DIAGRAMS; POTASSIUM HYDROXIDES; TRACE AMOUNTS

36812 (INIS-SU–93, pp. 39-44) **Effect of carrier nature and Pt concentration on catalytic properties of deposited catalysts with respect to reaction of homomolecular isotopic exchange of hydrogen.** Korabel'nikova, L.M.; Vasilevich, A.A. Ministerstvo Vysshego i Srednego Spetsial'nogo Obrazovaniya SSSR, Moscow (USSR); Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR). 1987. (In Russian). In *Isotopes in catalysis. Issue 147. Proceedings of the Moscow Chemical Technological Institute.* Order Number DE89012155/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Effect of carrier (Al_2O_3 and SiO_2) nature and Pt concentration in deposited catalysts with respect to reaction of homomolecular isotopic exchange (HMIE) of hydrogen at -196 deg C and 66,6 Pa (0.5 mm of mercury) is studied. Dependence of specific catalytic activity of Pt/Al_2O_3 and Pt/SiO_2 on platinum concentration is shown. It is found that large platinum crystallites in Pt/SiO_2 system have higher activity than small ones. The carrier effect on catalytic and surface properties of deposited platinum is detected. The most noticeably the carrier effect is manifested in the ranges of small degrees of carrier surface filling with metal. Optimum platinum concentrations in Pt/Al_2O_3 and Pt/SiO_2 catalysts for hyrogen HMIE reaction are determined. 17 refs.; 3 figs.; 1 tab.

36813 (INIS-SU–93, pp. 44-59) **Low-temperature isotopic exchange in molecular hydrogen on films of transition and rare earth metals and their alloys with copper.** Zhavoronkova, K.N.; Peshkov, A.V.; Boeva, O.A. Ministerstvo Vysshego i Srednego Spetsial'nogo Obrazovaniya SSSR, Moscow (USSR); Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR). 1987. (In Russian). In *Isotopes in catalysis. Issue 147. Proceedings of the Moscow Chemical Technological Institute.* Order Number DE89012155/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Model reaction of homomolecular deuterium-hydrogen exchange is used to study catalytic properties of a wide class of transition and rare earth metals (REM), and REM-copper alloys to determine interelation between catalytic activity and metal electron structure. The character of specific catalytic activity (K_{sp}) dependence on position in Sc-Y-La...Hf series, that is different for 77-120 K (1) and 120-193 K (2) temperature ranges is determined. Comparison of K_{sp} with metal sublimation heats permitted to coclude that catalytic activity is caused both by probability of electron occupying the 5d-level and their delocalization degree, that in its turn is connected with the degree of electron occupying the 4f-level. It is shown that REM-copper fusion increases K_{sp} by 1-2 order, that is due to electron and cluster effects. 20 refs.; 9 figs.

36814 (INIS-SU–93, pp. 59-71) **Catalytic properties of hydride-forming intermetallic compounds in reactions with the participation of hydrogen.** Andreev, B.M.; Magomedbekov, Eh.P.; Pak, Yu.S.; Firer, A.A. Ministerstvo Vysshego i Srednego Spetsial'nogo Obrazovaniya SSSR, Moscow (USSR); Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR). 1987. (In Russian). In *Isotopes in catalysis. Issue 147. Proceedings of the Moscow Chemical Technological Institute.* Order Number DE89012155/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Results of studying activity of hydride-forming intermetallic compounds (IMC) of two classes, namely, $LaNi_5$ type and titanium-bearing IMC in reactions of interphase and homomolecular (T-H) isotopic hydrogen exchange, as well as (D-H) isotopic exchange between hydrogen and water vapors are presented. Activation energy and hydrogen pressure reaction order are determined. On the basis of obtained kinetic regularities it is shown that the limiting stage of interphase isotopic exchange is atomic hydrogen transfer from the surface to IMC crystal lattice volume. The limiting stage of isotopic exchange between hydrogen and water vapors is hemisorbed hydrogen interaction with absorbed water vapors, i.e. formation (disintegration) of activated complex on IMC surface.

36815 (INIS-SU–93, pp. 71-79) **Catalytic activity in reactions of isotopic exchange of carbon monoxide and adsorption properties of cataiysts on zinc oxide base.** Mikheeva, T.M. (Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR)); Kasatkina, L.A.; Volynkina, A.Ya. Ministerstvo Vysshego i Srednego Spetsial'nogo Obrazovaniya SSSR, Moscow (USSR); Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR). 1987. (In Russian). In *Isotopes in catalysis. Issue 147. Proceedings of the Moscow Chemical Technological Institute.* Order Number DE89012155/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Activity of different zinc oxide samples in reaction of CO homomolecular isotopic exchnge (HMIE) ($^{13}C^{18}O+^{12}C^{16}O=^{13}C^{16}O+^{12}C^{18}O$), CO adsorption on ZnO and isotopic exchange between adsorbed and gaseous CO are investigated. The most active is ZnO sample prepared from $ZnCO_3$. Quantitative ratio between different with respect to surface strength molecules of adsorbed CO are experimentally determined. It is shown that by increase of ZnO time contact with CO the quantity of adsorbed CO($N_\sigma 0$/), capable of fast exchange with a gaseous phase, is reduced and the quantity of slowly exchanged adsorbed CO is increased. Correlation between decrease of $N_\sigma 0$/and decrease of CO HMIE with the catalyst holding time in CO medium is stated.

36816 (INIS-SU–93, pp. 79-84) **Homogeneous activation of molecular hydrogen: on the development of effective catalysts for isotopic exchange in protolytic media.** Sakharovskij, Yu.A. Ministerstvo Vysshego i Srednego Spetsial'nogo Obrazovaniya SSSR, Moscow (USSR); Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR). 1987. (In Russian). In *Isotopes in catalysis. Issue 147. Proceedings of the Moscow Chemical Technological Institute.* Order Number DE89012155/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Comparison of different catalytic systems for hydrogen isotopic exchange with protolytic solvent based on activation enthalpy and entropy values is carried out. Particular attention is paid to the effect of ligand environment of complex forming metallic central ion and solvent composition on free activation energy and stability of catalytic system. A conclusion is drawn on impossibility of absolutely stable and high-temperature catalyst in an isolated system.

36817 (INIS-SU–93, pp. 85-94) **Complexing and catalysis in reactions of chlorine isotopic exchange between aluminium chlorides and alkylchlorides in nonaqueous solvating solvents medium.** Zajtsev, S.A. (Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR)); Kalinin, G.M.; Nikitina, O.M.; Rozhkovskij, A.A.; Shalygin, V.A.; Ivanov, L.P.; Gorbunov, A.I. Ministerstvo Vysshego i Srednego Spetsial'nogo Obrazovaniya SSSR, Moscow (USSR); Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR). 1987. (In Russian). In *Isotopes in catalysis. Issue 147. Proceedings of the Moscow Chemical Technological Institute.* Order Number DE89012155/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Results of systematic study of chlorine isotopic exchange between $AlCl_3$-^{36}Cl and chlorides of aliphatic series in dipolar aprotic solvent medium are presented. It is shown that ionic forms of aluminium chloride solvating complexes are predominant in exchange reaction catalysis.

36818 (INIS-SU–97, pp. 74-77) **Electron structure and electrostatic potential of some neutral organophosphorus extractants and their complexes.** Varnek, A.A. (Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR)); Kuznetsov, A.N.; Petrukhin, O.M.; Sinegribova, O.A.; Korovin, V.Yu.; Randarevich, S.V. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Molecular electrostatic potential was used as a criterion of extraction ability of a series of neutral organophosphorus compounds: trimethylphosphate-trimethylphosphonate-trimethylphosphinate-trimethylphosphine oxide- and for analyzing mechanism of acid hydrolysis of alkylphosphates. Charge distribution in P=0 fragment was calculated by MNDO, CNDO/2 (sp), CNDO/2 (spa) methods. It was shown that negative charge on oxygen of phosphoryl group decreased from the first member of mentioned extractant series to the last one, while the extraction ability in this series increased. NMR data showed that changes in the electronic structure of tributhylphosphate (TBP) in complexes with Zr, Hf and Sc nitrates were similar to ones, observed in TBP complexes with HNO_3, but were more pronounced. Strond effect of cations of these metals on TBP electronic structure was considered to be the reason of their catalytic activity during acid hydrolysis of this extractant. 3 refs.; 4 figs.; 1 tab.

36819 (INIS-SU–97, pp. 176-179) **Role of the liquid-liquid partition coefficient of the extractable chelate in the extraction efficiency of metals with β-diketones.** Nobuo Suzuki (Tokyo Univ. (Japan)). AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Extraction of trivalent rare earths, Sc and Y from aqueous solutions by acetylacetone solutions in different organic solvents was studied. It is shown that coefficients of distribution of neutral chelates MAn of M^{3+} metal ions with acidic chelating agent HA are strongly affected by the nature of metal central ion and chelating ligands. In Sc(3) extraction by acetylacetone in heptane and octanol-1 the distribution coefficient grows with increase of acetylacetonate concentration and achieves the limiting value in the region of high concentrations of acetylacetonate. Extraction coefficient of Sc(3) chelate is much higher in all considered systems, as compared to Y(3) chelate. Coefficients of rare earth (3) extraction by acetylacetone grow linearly with increase of the value, inverse to their ionic radii. The difference of rare earth (3) extraction constants is explained by the difference both of formation constants and distribution constants of extracted chelates. 10 refs.; 3 figs.

36820 (INIS-SU–97, pp. 191-194) **Complexones in the processes of extraction of rare earth elements.** Korpusov, G.V. (AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii); Krylov, Yu.S.; Danilov, N.A.; Evseeva, N.K. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Complexone application in extractive separation of rare earths is considered. Recommendations on the choice of extractive system with regard to the character of change of extractant and complexone selectivity in rare earth series are given. Main requrements for such systems were formulated. Fulfilment of these requirements provides for the maximal separation factors. Typical examples of effective separation and purification of rare earths in extractive systems with complexones are given complexones are given. 6 refs.; 12 figs.; 2 tabs.

36821 (INIS-SU–97, pp. 104-107) **Outer-sphere hydration of metal chelates and its role in liquid-liquid partition equilibria.** Narbutt, J. (Inst. of Nuclear Chemistry and Technology, Warsaw (Poland)). AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Role of hydration phenomenon in extraction separation of metals is discussed. Data on BeL_2, CrL_3, NpL_4, ZnL_2 (L- acetylacetone) solvent extraction were used to support earlier advanced hypothesis about formation of hydrogen bonds between molecules of dissolved chelate and water molecules from aqueous phase; donor oxygen atoms of coordinated ligands represent the centers of outer-sphere hydration. It is shown that the degree of outer-sphere hydration increases with growth of valency of metal-complexing agent atom and electronegative character of ligand donor atom. It is noted that salting out effect in metal chelate separation, caused by inert electrolytes, is also connected with hydration in aqueous phase. The conclusion is made about the important role of outer-sphere hydration in processes of liquid-liquid separation of metal complexes and about the necessity of taking it into account in further development of models of liquid extraction of metal ions. 12 refs.; 1 tab.

36822 (INIS-SU–97, pp. 111-115) **Micelle formation during extraction of alkali elements from strongly alkaline mediums.** Apanasenko, V.V. (Moskovskij Inst. Tonkoj Khimicheskoj Tekhnologii, Moscow (USSR)); Reznik, A.M.; Bukin, V.I.; Brodskaya, A.V. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Extraction of potassium, rubidium and cesium by phenol reagents in hydrocarbon solvents from strongly alkakine solutions was considered. Tendency of prepared alkali metal phenolates to form micelles in aqueous and organic phases was revealed. Phenolates tendency to form micelles is dictated mainly by the size and position of hydrocarbon substituent in molecule. It is shown that when micelles form in organic phase, alkali elements can be extracted both according to cation-exchange mechanism and according to micellar one. It is noted that alkai element extraction from strongly alkaline media requires the correct choice of extractant: alkali metal phenolate shouldn't form micelles in aqueous solution. n-Alkyl- and arylphenoldisulfides and polysulfides are most preferable for solvent extraction among considered phenol derivatives. 4 refs.; 3 figs.

36823 (INIS-SU–97, pp. 183-186) **Solvent extraction of scandium pigrate by crown ether and crystal structure of complex between picrate and benzo-15-crown-5.** Zhou, Z.X. (Sichuan Univ., Chengdu (China)); Du, C.Kh.; Zhou, Z.H.; Yu, K.B.; Zhou, Z.Y. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Mechanism of scandium picrate solvent extraction by benzo-15-crown-5(B15C5) solution in dichloroethane was studied and composition of extracted complex $Sc(OH)(pic)_2(B15C5)$ was established. The crystal, corresponding to extracted complex with respect to composition, was synthesized in acetonitrile and ethanol mixture. Data of element analysis and colorimetry showed that its composition corresponded to $Sc(pic)_3$center dot$(B15C5)_2$center dot$2H_2O$center dotCH_3CN. Crystals are triclinic, lattice parameters:

a=12.768, b=13.76, c=19.440 A; d81.03, β=70.88, γ=70.71 deg. Data of X-ray diffraction analysis show, that Sc^{3+} is bound with three picrate-aniones and two water molecules. Each picrate-anion is bound with Sc^{3+} by two donor oxygen atoms of phenol group and one of nitrogroups. Two molecules of B15C5 are associated with Sc^{3+} due to formation of hydrogen bond between coordinated water and ether oxygen atoms. 8 refs.; 3 figs.

36824 (INIS-SU–97, pp. 108-110) **State of water in extracts and its interaction with microwave field.** Chekmarev, A.M. (Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR)); Kharlamov, V.V.; Chibrikina, E.I.; Kharlamova, I.M. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

A study was made on the reasons of different behaviour of extractive systems, based on primary and ternary amines. It is shown that the whole complex of experimental data on zirconium sulfate extraction by these amines can be explained, if it is assumed that reverse micelles with different water content in cavities form in extract phase. The assumption was confirmed by results of measuring dielectric permittivity and viscosity of extracts, as well as their heating rates under the effect of microwave radiation. 3 refs.; 1 fig.

36825 (INIS-SU–97, pp. 120-122) **Hydration and solvation energies and thermodynamic distribution coefficient of some extraction systems.** Kulawik, I. (Institute of Nuclear Physics, Cracow (Poland)); Kulawik, J.; Mikulski, J. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Hydration and solvation energies, thermodynamic and analytic coefficients of distribution were determined for some extractive systems with tributylphosphate (TBP) and acetylacetone (AA), including TBP-UO_2Cl_2-HCl, TBP-$ThCl_4$-HCl, AA-$InCl_3$-HCl system. It is shown, that the more is the difference of solvation and hydration energies in extractive system, the more is separation coefficient. 4 refs.; 1 fig.; 1 tab.

36826 (INIS-SU–97, pp. 203-205) **Studies of the influence of different anions on extraction of neodymium with di(1-methylheptyl)methyl phosphonate.** Chun-Hui Huang (Beijing Normal Univ., BJ (China). Inst. of Low Energy Nuclear Physics); Rong-Fang Xi; Hai Guo; Guang-Xian Xu. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

A study was made on extraction of $Nd(NCS)_3$, $Nd(ClO_4)_3$, $Nd(NO_3)_3$ by di-(1-methylhexyl)methyl phosphonate (P-350) in hexane. ΔG^0(kJ/mol), ΔH^0(kJ/mol) and ΔS^0(kJ/mol) were calculated. They are equal to: -9.719, -29.92, -67.78 for P-350(hexane)-$Nd(NCS)_3$ system; 3.752, -74.31, -261.9 for P-350(hexane)-$Nd(ClO_4)_3$ system; 2.265, -22.69, -83.68 for P-350(hexane)-$Nd(NO_3)_3$ system. Structure of extracted complexes in hexane solution and corresponding solid complexes were correlated with triphenylphosphine oxide as P-350 model. Data of IR-spectroscopy show, that absorption bands of complexes in saturated organic solvents or in the solid phase are shifted to the region of lower frequencies as compared to absorption bands of corresponding salts. This testifies to similarity of complex structures in both phases. 6 refs.; 2 tabs.

36827 (INIS-SU–97, pp. 213-216) **Complex formation of lanthanide(111) with acetylacetone studied by the akufve-lison technique.** Albinsson, Y. (Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Nuclear Chemistry); Rudberg, J. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Complexing of trivalent lanthanides (Ln=Nd, Pm, Sm, Eu, Tb, Ho, Tm, Lu) with acetylacetone (HAA) in two-phase extractive system (0.1-4M)HAA in benzene-aqueous solution of 1M Na(H)ClO_4 at pH 3-9 was studied by the AKUFVE-LiSOL technique. Experiments were conducted in inert atmosphere at 25 deg C and Ln concentration 10^{-6}-10^{-4} M. The data obtained enabled to evaluate the contributions of different complex forms to the total complexation during solvent extraction. Equilibrium constants of these forms were calculated, the dependence of $Ln(AA)_3$ distribution constants and adduct formation constants on Ln atomic number was determined. It was shown that low distribution coefficients of neutral complexes (D=0.05-1.3) were related with hydration of extracted particles by 2-3 water molecules. 8 refs.; 1 fig.; 1 tab.

36828 (INIS-SU–97, pp. 217-219) **Mechanism of extraction 4th period of periodic system metal ions with carboxylic acids in sulphate systems.** Kopacz, S. (Ignacy Lukasiewicz Technical Univ. Rzeszow (Poland)). AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Extraction of transition metal ions of the 4th period of Periodic system by carboxylic acids in sulfate systems was studied. It is shown that depending on composition and physicochemical properties of aqueous phase (pH, the type of metal ion, its complexing properties etc.) the solvent extraction may proceed according to two mechanisms: cation-exchange or hydration-solvation. The extraction is more effective in the field of cation-exchange mechanism. 6 refs.; 1 fig.; 1 tab.

36829 (INIS-SU–97, pp. 237-240) **Low-coverned nature of association (micellation) of dialkylphosphates in water and organic phases and their manifestation in the process of metal extraction with dialkylphosphoric acid.** Golovanov, V.I. (Chelyabinskij Univ. (USSR)). AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

A study was made on micellation of di-n-butyl- and di-(2-ethyhexyl)phosphates with Co^{2+}, Ni^{2+}, Cu^{2+}, Cd^{2+}, Zn^{2+} cations in water and extracts, as well as on dependences of their distribution in water and organic solvents (n-heptane, toluene, tetrachloromethane) at the ratio of water and organic phase volumes equal to 1:1 and at 25 deg C. Three types of distribution isotherms, corresponding to oleophilic, hydrophilic and amphiphilic micellation surfactants (MSAS) were revealed in experiments. Distribution isotherms of oleophilic and hydrophilic MSAS are explained easily by the pseudophase micellation model. The results obtained show that quantitative description of metal extraction by dialkylphosphoric acids is limited by their micellar association in organic and water phases. 6 refs.; 3 figs.; 3 tabs.

36830 (INIS-SU–97, pp. 244-247) **Physico-chemical study of extraction systems by the method of solubility diagrams.** Tanasheva, M.R. (Kazakhskij Gosudarstvennyj Univ., Alma-Ata (USSR)). AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Method for mathematical description of liquid-loquid and liquid-liquid-solid equilibria was developed. The method was used to evaluate phase state of systems, containing inorganic acids (HCl, HNO_3, H_2SO_4, H_3PO_4, H_3BO_3), alkali and alkaline earth metal salts, water and neutral extractions (ketones, alcohols, N,N-dialkylamides). Composition of extracted complexes could be determined from the phase diagrams. The data obtained enabled to conclude that suggested approach was more informative than other methods, because it permitted to estimate the whole statics of the

extraction process and determine the composition of coexisting phases without their isolation and separate investigation. 3 refs.; 3 figs.

36831 (INIS-SU–97, pp. 260-263) **Size-selective extraction of metal salts: the general principles.** Yakshin, V.V. (AN SSSR, Moscow (USSR). Inst. Geokhimii i Analiticheskoj Khimii). AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Consideration is given to application of the structural correspondence principle for explaining processes of selective (with respect to ion size) solvent extraction of metal salts from aqueous solutions to organic phase by crown-ethers of different spatial and electronic structure. A study has been made on more than 50 different structures of cyclic and acyclic polyethers, containing aromatic, aliphatic and cycloaliphatic fragments. It is shown that introduction of additional substituents enables to increase extraction selectivity and separate elements with similar chemical properties. 6 refs.; 3 tabs.

36832 (INIS-SU–97, pp. 268-270) **New bis(grown ether)s as extraction agents.** Aurich, J. (Akademie der Wissenschaften der DDR, Dresden (German Democratic Republic). Zentralinstitut fuer Festkoerperphysik und Werkstofforschung); Holdt, H.-J.; Gloe, K.; Muhl, P.; Kuntosch, G. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Extraction properties of crown-ethers of different compositions with respect to Na^+, K^+, Rb^+, Cs^+, Sr^{2+}, Ag^+ ions were studied. Extraction constants of these ions were determined. It was shown that cesium-selective extractant was presented by one of investigated bis-crown-ethers of B18C6 type. Possibility of determining composition of formed complexes of K^+, Rb^+, Cs^+, Ag^+ ions with bis-crown-ethers by the method of conductometric titration was noted. 7 refs.; 2 figs.

36833 (INIS-SU–97, pp. 271-273) **Synergic extraction of metals with 4-acylpyrazol-5-ones and grown ethers.** Sastre, A. (Bilbao Univ. (Spain). Escuela Tecnica Superior de Ingenieros Industriales); Sahmoune, A.; Brunette, J.P.; Leroy, M.J.F. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

A study was made on extraction of bivalent transition metals (Cu, Co, Zn, Cd) by mixtures of 1-phenyl-3-methyl-4-benzoylpyrozol-5-one (HPMBP) and crown-ethers with different cavities size from aqueous media, containing LiCl, NaCl, KCl, CsCl, $NaNO_3$ or $Ba(NO_3)_2$. Effect of symergetic extraction was revealed. Analysis of distribution data showed, that composition of extracted samples in organic phase depended on the type of electrolyte cation. 5 refs.; 2 tabs.

36834 (INIS-SU–97, pp. 276-279) **Ionizable polyethers as specific metal ion carriers in liquid-liquid extraction and liquid membrane separations.** Walkowiak, W. (Warsaw Univ. (Poland)); Charewicz, W.A.; Bartsch, R.A.; Ndip, G.M. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Consideration is given to results of investigations into competitive extraction and penetration through a liquid membrane of alkali and alkaline earth cations from aqueous solutions by a series of lipophilic and ionizable acyclic polyethers of various molecular structure. It is shown that specificity and selectiviy of cation carriers in liquid-liquid extraction and liquid membrane separation depend on molecular structure of acyclic polyethers. 12 refs.

36835 (INIS-SU–97, pp. 280-283) **Studies on extraction of metals with 3-phenyl-4-acyl-5-isoxazolones- new series of chelating extraction.** Jyothi, A. (Indian Inst. of Tech., New Delhi (India). Dept. of Chemistry); Rao, G.N. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

A study was made on extraction of some bivalent transition metals and Cd(2) by 3-phenyl-4-acetyl-5-isoxazolone (HPAD) in methylisobutyl ketone and by 3-phenyl-4-benzoyl-5-isoxazolone (HPBI) in chloroform. It is shown that HPAI extracts only 25% of Cd(2) at pH 8.8 and HPBI-90% in pH 8.0-9.0 range. The extraction mechanism includes addition of two liqand molecules to metal ion with release of two protons. 13 refs.; 5 figs.; 1 tab.

36836 (INIS-SU–97, pp. 297-300) **Extractants for boron.** Alekperov, E.R. (AN Azerbajdzhanskoj SSR, Baku (USSR). Inst. Neorganicheskoj i Fizicheskoj Khimii); Reznik, A.M. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Boron extraction by 2-hydroxy-5-octylbenzylethanolamine (OBEA) in organic solvents (benzene, hexane, heptanol, CCl_4, methylethylketone) was studied. The dependence of boron extraction by OBEA on pH passes through the maximum for all studied solvents. The maximall distribution coefficients are observed in the region of pH 5.0-7.5. Molar ratio boron: OBEA in the formed complex equals 1:1; it is constant and is independent of hydrogen ion concentration in the system. Complex composition corresponds to formula $C_{17}H_{28}O_3NB$, m.p.=148-149 deg C. Coordination bond of boron with nitrogen in the molecule is responsible for formation of chelate center, which includes penta- and hexamembered cycles stabilizing the complex.

36837 (INIS-SU–97, pp. 209-212) **Mechanism of nitric acid and strontium extraction with zirconium di-2-ethylhexyl phosphate complexes-studying by the ^{14}N and ^{31}P NMR methods.** Vashman, A.A. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)); Nikiforov, A.S.; Pronin, I.S.; Smelov, V.S.; Shesterikov, V.N. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

^{14}N and ^{31}P NMR methods were used to study strontium and nitric acid solvent extraction by zirconium complexes with di-2-ethylhexyl phosphoric acid (HA) in $ZrA_4(HA)_2$-$C_{10}H_{22}$-H_2O-HNO_3-Sr system, depending on concentration of its components. It is proposed that strontium extraction into organic phase proceeds by means of $ZrA_4(HA)_2$ complex, in which one Sr^{2+} ion is substituted for two protons in HA molecules, solvating ZrA_4 complex, with formation of ZrA_4center dotSrA_2 complex. 1 ref.; 4 figs.

36838 (INIS-SU–97, pp. 301-304) **Some possibilities for improvement of the extraction properties in mixed extraction systems.** Hadjiev, D. (Bylgarska Akademiya na Naukite, Sofia (Bulgaria)); Galabova, G. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Possibilities of improving extractive properties of acid extractants are considered. A new type of extraction system, composed of cation and anion extractants (fatty acids, D2EHPA, amines) in kerosene, containing 2 vol.% tributylphosphate as an emulsion inhibitors, is described. Study of cadmium and other metal extraction by mixed extractants shows that amine addition enables to correct pH value in the extraction system and achieve higher distribution coefficients of metal. The results obtained demonstrate high potentialities of mixed extraction systems of this type. These systems use

conventional acidic and basic components, therefore they form a basis for further development of selective extraction systems by a simple modification of the structure of individual components of the extractant. 9 refs.; 2 figs.; 2 tabs.

36839 (INIS-SU–97, pp. 305-309) **Petroleum sulfides, sulfoxides, and sulfones used as extragents.** Nikitin, Yu.E. (AN SSSR, Ufa (USSR). Inst. Khimii); Lyapina, N.K.; Murinov, Yu.I. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Possibilities of using petroleum sulfides, sulfoxides and sulfones for extraction and separation of wide range of elements are considered. It is shown that petroleum sulfides appear to be effective and selective extractants in extraction and separation of noble metals (Ru, Au, Pt, etc.). Petroleum sulfoxides are promising for solvent extraction of transition metals, actinides, rare earths etc. 4 refs.; 2 figs.

36840 (INIS-SU–97, pp. 318-320) **Extraction of zinc(2), cadmium(2), copper(2) and iron(3) by cyanex 272.** Figuerola, E. (Bilbao Univ. (Spain). Escuela Tecnica Superior de Ingenieros Industriales); Miralles, N.; Sastre, A.; Aguilar, M. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

A study was made on extraction of zinc(2), cadmium(2), copper(2) and iron(3) from aqueous solutions by CYANEX 272 extractant dissolved in Isopar-H at 25 deg C. Equilibrium constants of extraction, as well as the dependences of distribution coefficients on pH and extractant concentration at steady metal concentration (10^{-4} mol.dm^{-3}) were determined. 8 refs.; 1 tab.

36841 (INIS-SU–97, pp. 321-325) **Trials on the molecule design of organic extractants.** Chengye Yuan (Academia Sinica, Shanghai, SH (China). Shanghai Inst. of Organic Chemistry); Shusen Li. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Contribution of structural parameters into extractive behaviour of ligands is considered. It is shown that reactivity of the central atom or group of atoms, the steric effect and ligand solubility are the basic structural factors determining the extraction behaviour. Data on rare earth (Nd, Sm, Y, Yb) extraction enable to conclude that there are quantitative relationships between the separation factor and the steric parameters. These relationships permit on the one hand to estimate the separation factor of rare earth pairs when using any extractant and on the other hand to choose the most effective one for separation of this pair. The methods of measuring for steric effect of substituent are suggested. 13 refs.; 2 tabs.

36842 (INIS-SU–97, pp. 326-329) **Regularities of the extraction of rare earth elements with triisoamyl phosphate.** Danilov, N.A. (AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii); Korpusov, G.V.; Utkina, O.V.; Pogorel'skaya, S.A. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

A study was made on practically important regularities of rare earth element (REE) extraction by triisoamyl phosphate (TiAP): isotherms of REE extraction, effect of REE and salting-out agents concentrations in aqueous phase on REE distribution and separation coefficients, effect of HNO_3 concentration and others. The data obtained show, that TiAP is the typical representative of neutral organophosphoric compounds, and its extraction properties are close to those of TBP. The third phase doesn't form during REE nitrate extraction by TiAP solutions in saturated hydrocarbons of any concentration. High selectivity is not observed during separation of cerium subgroup REE by TiAP. TiAP losses are lower than those of TBP due to lower TiAP solubility in water. 2 refs.; 7 figs; 3 tabs.

36843 (INIS-SU–97, pp. 330-335) **Some regularities of extraction of rare earth elements by organophosphoric acid.** Korpusov, G.V. (AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii); Keimirov, M.A.; Danilov, N.A.; Djumauradov, B. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Consideration is given to results of investigation of extraction of rare earth macroquantities from nitrate solutions by D-2-isopropyl-5-methylhexylphosphoric and 2-isopropyl-5-methylhexylphosphoric acids. It is shown that extractant selectivity decreases with increase of aqueous phase acidity. The selectivity is usually higher against the background of macroquantities of weakly extracted component, but some times another dependence is observed. It is noted that substitution of the diluent for more polar one which monomerizes extractants, leads to the loss of selectivity. But in small guantities polar diluents provide the stability of the extraction system for formation of sediments. Both sampls of organophosphoric acids provide for extraction process at low HNO_3 concentrations without rick of sediment formati on of extracted compounds in organic phase. 1 ref.; 15 figs.; 4 tabs.

36844 (LA-UR–89-1883) **Atomic oxygen-MoS_2 chemical interactions.** Cross, J.B.; Martin, J.A.; Pope, L.E.; Koontz, S.L. Los Alamos National Lab., NM (USA). 1989. 13p. Sponsored by DOD;DOE/MA;NASA. DOE Contract W-7405-ENG-36;AC04-76DP00789. (CONF-890468–12: 16. international conference on metallurgical coatings and equipment exhibit, San Diego, California, USA, 17-21 Apr 1989). Order Number DE89014241/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The present study shows that, at 1.5 eV O-atom translation energy, SO_2 is generated and outgases from an anhydrous MoS_2surface with an initial reactivity nearly 50% that of kapton. The reaction of atomic oxygen with MoS_2 has little or no translational energy barier; i.e., thermally generated atomic oxygen reacts as readily as that having 1.5 eV of translational energy. It is also shown that water, present in the flowing afterglow apparatus used to study thermal O-atom reactivity, formed sulfates on the MoS_2 surface and that the sulfate is not likely in the form of sulfuric acid. These results imply that water dumps or outgasing in low earth orbit have the potential of forming sulfuric acid covered surfaces on MoS_2 lubricants. For MoS_2 films sputter-deposited at 50-70°C, friction measurements show a high initial friction coefficient for O-atom exposed MoS_2 surfaces (up to 0.25) which drops to the normal low values after several cycles of operation in air and ultrahigh vacuum. For MoS_2 films deposited at 200°C, the friction coefficient was not affected by the O-atom exposure. 11 refs., 3 figs.

36845 (LBL–25559) **Tritium labeling by thermally generated tritons.** Morimoto, H.; Williams, P.G.; Saljoughian, M. Lawrence Berkeley Lab., CA (USA). Jun 1988. 6p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-880787–8: 3. international symposium on the synthesis and applications of isotopically labeled compounds, Innsbruck, Austria, 17-21 Jul 1988). Order Number DE89014904/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The predominant effect of thermal atom irradiation on solid molecules is saturation of their aromatic functions. Only low level of tritium exchange is observed for aliphatic solids. In contrast, liquids whose frozen surface can be rendered somewhat mobile at appropriate temperatures exhibit more exchange than addition. The rank order of effectiveness of several metals in promoting exchange/addition appears similar to the rank order for heterogeneous catalytic hydrogenation. 3 refs., 8 figs.

36846 (PNL-SA–16621) **Electrospray ionization-mass spectrometry and tandem mass spectrometry.** Loo, J.A.; Barinaga, C.J.; Edmonds, C.G.; Udseth, H.R.; Smith, R.D. Pacific Northwest Lab., Richland, WA (USA). May 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-8905166–1: American Society for Mass Spectroscopy annual

symposium, Miami Beach, Florida, USA, 22-26 May 1989). Order Number DE89014465/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The ability to produce multiply charged molecular ions for biomolecules allows mass spectrometers to analyze compounds with molecular weights much in excess of the instrument's mass limit, but within the mass-to-charge range of most conventional mass spectrometers. In fact, proteins with molecular weights in excess of 130,000 daltons have been successfully analyzed by ESI-MS with a quadrupole mass spectrometer of limited m/z range (1700) in our laboratory. We have compared the ESI mass spectra of large proteins with and without reduction of its disulfide bridges. By cleavage of cysteine-cysteine bonds and thereby affecting the tertiary structure of the protein, a dramatic increase in the number of positive charges is observed. Highly charged ions desorbed from the droplets are sampled through a nozzle-skimmer orifice to be detected by the quadrupole mass spectrometer. Increasing collision energies also yields significant fragmentation of large peptide and proteins. 3 refs.

36847 (UCID–21710) **The equation of state of perfluorododecane to 48 GPa.** Simpson, R.L.; Helm, F.H.; Cook, T.M. Lawrence Livermore National Lab., CA (USA). 24 May 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89014306/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Shock Hugoniot states of perfluorododecane were determined between 0.7GPa and 23GPa. The material has significant curvature in the U_s-u_p plane below 5GPa. Off Hugoniot states were determined up to 48GPa using a reflected shock technique. Deviations in the P-V and U_s-u_p relationships between 22GPa and 30GPa indicate the possibility of material decomposition at these shock pressures. Further work is required to verify that this is not just an experimental artifact. The effect of gelling with 3 wt % of SiO_2 resulted in no discernible difference in the Hugoniot behavior. 2 refs., 10 figs., 5 tabs.

36848 (UCRL–21083) **High-temperature optical-fiber pH sensor: Final report.** Angel, S.M.; Poco, J.F. Lawrence Livermore National Lab., CA (USA). Jun 1989. 31p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89014103/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this report, the results of research on high-temperature optical-fiber pH sensors will be presented. We have shown that these sensors (optrodes) can be made to work in very-high-temperature (300°C) water for long periods and that it is possible to measure pH using fluorescent inorganic ions doped into solid matrices. A high-temperature pH optrode can be made using these techniques; however, more research is needed into the chemistry of the carrier matrices and fluorescent dopants. New types of materials should be studied, including solid polymer ionic conductors and high-temperature epoxies. Particular emphasis should be placed on developing an Eh optrode because it also will be very useful and probably more easily developed. Transition-metal ions and complexes, as well as certain stable organic dyes, (materials that are very stable at high temperature) should also be investigated as dopants. 5 refs., 22 figs.

36849 (UCRL–53922) **Kinetics of the gas phase tritium oxidation reaction.** Failor, R.A. Lawrence Livermore National Lab., CA (USA). 27 Mar 1989. 289p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89014605/JAW. Available from NTIS, PC A13/MF A01 - OSTI; GPO Dep.

Thesis. Submitted to Univ. of California, Berkeley.

Homogeneous gas-phase kinetics of tritium oxidation ($2T_2 + O_2 \rightarrow 2T_2O$) have been studied with a model that accounts explicitly for radiolysis of the major species and the kinetics of the subsequent reactions of ionic, excited-state, and neutral species. This dissertation includes a detailed calculation of the radiolysis product distribution due to the tritium beta decay, with special attention to oxygen radiolysis. Adjustments were made to hydrogen-based rate constants, obtained from the literature, to account for kinetic isotope effects. The effects of self-radiolysis of pure T_2 on the tritium oxidation reaction were calculated. Tritium atoms, the primary product of T_2 self-radiolysis, altered the oxidation mechanism only during the first few seconds following the initiation of the $T_2 - O_2$ reaction. Ozone, an important intermediate in T_2 oxidation, was monitored in-situ by uv absorption spectroscopy for 0.01 – 1.0 mol% in 1 atm O_2. The shape of the experimental ozone time profile agreed with the model predictions. As predicted, the measured initial rate of ozone production varied linearly with initial T_2 concentration ($[T_2]_0$), but at an initial rate one-third the predicted value. 167 refs., 37 figs., 18 tabs.

36850 Background correction in photothermal deflection spectroscopy using a single position sensor. Spear, J.D. (Lawrence Berkeley Lab., Mail Stop 90-2024, Berkeley, CA (US)); Russo, R.E.; Silva, R.J. v.v of 1988 Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy (abstracts). Pittsburgh Conference, Pittsburgh, PA (1988). (CONF-880204–: 39. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, New Orleans, LA, USA, 22-26 Feb 1988).

Technical Paper NO. 537.

Photothermal spectroscopic techniques, such as photoacoustic, thermal lensing, and photothermal deflection have been well recognized for their ability to measure ultra-sensitive optical absorption in transparent and opaque media. However, the sensitivity of these techniques is often limited by background absorption. In this paper, the authors describe a differential dual-beam photothermal deflection spectrometer using only a single position sensor to correct for background absorption.

36851 A new potentiometric method for the estimation of the rare earth elements. Selig, W.S. (Lawrence Livermore National Lab., Livermore, CA (US)). v.v of 1988 Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy (abstracts). Pittsburgh Conference, Pittsburgh, PA (1988). (CONF-880204–: 39. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, New Orleans, LA, USA, 22-26 Feb 1988).

Technical Paper NO. 694.

Chinese workers recently described a new potentiometric method for lead using sodium tetraphenylborate (NaTPB) as a titrant. Based on a previous Chinese publication, the authors have recently developed a method for the estimation of the alkaline earth metals by sequential titration with NaTPB. In the present work, the authors report a similar method for the estimation of the rare earth elements, including Sc and Y. The sensing electrode is a spectrographic graphite rod, coated with a solution of poly(vinyl chloride) and dioctylphthalate in tetrahydrofuran as previously described. The reference electrode was a double-junction Ag/AgCl electrode. The titration system is controlled by a Tektronix 4051 graphics computer system. Single cations or mixtures up to 0.5 mequiv are determined by potentiometric titration with 0.05 N NaTPB, after formation of the oxonium cations by reaction with an aqueous solution of poly(ethylene glycol) (PEG). Best results are obtained with PEGs of molecular weights from 8,000 to 20,000. Sequential estimation of Pb + Ba, Sr, and Ca, and the sum of the rare earth elements is also reported, plus possible applications to Al, Ga, and anions precipitated by lead.

36852 Study of the separation of two overlapping compounds in preparative liquid chromatography. Ghodbane, S. (Oak Ridge National Labs., Analytical Chemistry Div., Oak Ridge, TN (US)); Guiochon, G. v.v of 1988 Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy (abstracts). Pittsburgh Conference, Pittsburgh, PA (1988). (CONF-880204–: 39. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, New Orleans, LA, USA, 22-26 Feb 1988).

Technical Paper NO. 1154.

In preparative chromatography, columns are overloaded and operated under conditions where equilibrium isotherms are no longer linear. Accordingly, the retention times of the peak maximum vary with increasing sample size, the peaks broaden and become more and more unsymmetrical. Thus, it is virtually impossible to make any accurate prediction of the peak profiles from simple chromatographic theory. The theoretical prediction can be made by writing the mass balance equation for each component of the sample in a given slice of the column and integrating the system of partial differential equations obtained. The boundary conditions are defined by the injection characteristics (i.e., the profile of the input band), and the multi-component, competitive isotherm must be known. The results obtained so far are very encouraging. The model is very

powerful and is used to study the influence of various experimental parameters involved in the prediction of band profiles.

36853 Protolytic properties of perxenic acid. Klaening, U.K. (Aarhus Univ. (Denmark)); Appelman, E.H. *Inorganic Chemistry (USA)*, 27(21): 3760-3762 (19 Oct 1988).

Spectra and protolytic properties of aqueous perxnic acid in the pH range -0.2 to 13 were studied by conventional and stopped-flow spectrophotometry. The following pK values and limits were found (25.0°C): $pK_{H4}XeO_6 < 0$, $pK_{H3}XeO_6^- = 4.29$ {plus minu} 0.03; $pK_{H2}XeO_6^{2-} = 10.81$ {plus minu} 0.04. The enthalpy of dissociation 25.0°C of $H_3XeO_6^-$ is 0 {plus minu} 5 kJ mol^{-1}; that of $H_2XeO_6^{2-}$ is 3 {plus minu} 2 kJ mol^{-1}. 12 references, 4 figures, 1 table.

4004 Electrochemistry

Refer also to citation(s) 36223, 36652, 37021

36854 (LBL–27046) **Electrochemically adsorbed Pb on Ag (111) studied with grazing- incidence x-ray scattering.** Kortright, J.B.; Ross, P.N.; Melroy, O.R.; Toney, M.F.; Borges, G.L.; Samant, M.G. Lawrence Berkeley Lab., CA (USA). Apr 1989. 6p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8905161–1: International conference on surface and thin film studies using glancing-incidence x-ray and neutron scattering, Marseille, France, 31 May - 2 jun 1989). Order Number DE89013424/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Grazing-incidence x-ray scattering studies of the evolution of electrochemically deposited layers of lead on silver (111) as a function of applied electrochemical potential are presented. Measurements were made with the adsorbed layers in contact with solution in a specially designed sample cell. The observed lead structures are a function of the applied potential and range from an incommensurate monolayer, resulting from underpotential deposition, to randomly oriented polycrystalline bulk lead, resulting from lower deposition potentials. These early experiments demonstrate the ability of in situ x-ray diffraction measurements to determine structures associated with electrochemical deposition. 6 refs., 4 figs.

4006 Radiation Chemistry

Refer also to citation(s) 35821, 36769

36855 (JAERI-M–88-272) **Annual report of the Osaka Laboratory for Radiation Chemistry, Japan Atomic Energy Research Institute, (no. 20). April 1, 1986 - March 31, 1987.** Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1989. 52p. Order Number DE89790927/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

This report describes research activities of Osaka Laboratory for Radiation Chemistry, JAERI during one year period from April 1, 1986 through March 31, 1987. The latest report, for 1985, is JAERI-M 87-046. Detailed descriptions of the activities are presented in the following subjects: studies on surface phenomena under electron and ion irradiations; polymerization under the irradiation of electron beams; modification of polymers, degradation, cross-linking, and grafting.

36856 The aqueous chemistry of iodine. Toth, L.M. (Oak Ridge Nat. Lab., Oak Ridge, TN (US)); Pannell, K.D.; Kirkland, O.L. v.v of Proceedings of the American Nuclear Society meeting on fission-product behaviour and source term research. American Nuclear Society, La Grange Park, IL (1985). (CONF-8507160–: ANS meeting on fission product behaviour and source term research, Snowbird, UT, USA, 15-19 Jul 1985).

The chemistry of iodine has been examined in aqueous solutions of pH 6 to 10 containing 2500 p.p.m. boron as H_3BO_3 at (temperatures up to 150°C) using absorption spectrophotometry to identify and monitor the iodine species present. Kinetic rate constants for the disproportionation of the HOI intermediate, $3HOI \rightleftharpoons IO_3^- + 2I^- + 3H^+$, have been measured as a function of pH even though no direct spectral evidence for HOI itself has been observed. An HOI partition coefficient $>10^4$ has been estimated; results of ionic strength tests are consistent with HOI being present as an uncharged triatomic species in solution. Redox and radiation effects on the aqueous iodine chemistry have also been described.

4007 Radiochemistry and Nuclear Chemistry

Refer also to citation(s) 35790, 36729, 36764, 36821, 36831, 36839, 37140, 37158

36857 (INIS-mf–11445) **Guidelines for the practice of radiopharmacy.** Australian and New Zealand Society of Nuclear Medicine, North Melbourne (Australia). May 1988. 31p. Order Number DE89616655/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The main objective of the guidelines is to establish minimum standards for the practice of radiopharmacy in Australia and New Zealand. The guidelines are intended to provide a basis for the safe and efficient practice of radiopharmacy in a hospital or clinical environment. They cover premises in which radiopharmacy is practised; procurement and use of sealed and unsealed radioactive sources; radiopharmaceutical HOT LAB dose preparation; routine quality control procedures; dispensing of radiopharmaceuticals; distribution of radiopharmaceuticals; record keeping; basic radiation protection procedures; consultation and education; research and development; and the preparation of sterile radiopharmaceuticals.

36858 (INIS-SU–97, pp. 78-81) **Application of eda interactions for explaining and forecasting the extractive ability of elementoorganic reagents.** Laskorin, B.N. (AN SSSR, Moscow (USSR). Inst. Geokhimii i Analiticheskoj Khimii); Yakshin, V.V.; Filippov, E.A. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Consideration is given to applicability of the principle of free energy linearity for explamation and forecasting of extraction ability of organic phosphorous compounds (OPC) in the processes, proceeding according to the mechanism of electron donor-acceptor interactions. Linear equations with high correlation coefficients were obtained for the process of extraction of nitric acid, actinide (An=V, Np, Pu, Am) and zirconium nitrates by neutral OPC. These semiempirical equations, relating donor properties and OPC electronic structure with their extraction ability, enable to forecast rather reliably the behaviour of heterophase solvent extraction systems. 3 refs.; 2 tabs.

36859 (INIS-SU–97, pp. 62-69) **Prediction and control of extraction ability and some physico-chemical properties of extractants.** Rozen, A.M. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)). AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Results of investigations on solvent extraction of metals, including rare earths and actinides, by different extractions are generalized. Methods of forecasting and regularities, responsible for extraction ability (EA) of mono- and bidentate neutral compounds, organic acids, crown-esters are discussed. Consideration is given to correlation EA dependences on various characteristics of extractant molecules, such as electronegativity of substituents of the active (donor) center, basicity constant, energy of internal levels of oxygen atom, ionization potential, affinity to proton and others. Possibility of directed regulation and improvement of some physicochemical properties of extractants is shown. 27 refs.; 8 figs.; 1 tab.

36860 (INIS-SU–97, pp. 123-126) **Thermodynamics of solvent extraction on $(C_8H_{17})_3N$-$C_6H_5CH_3$-UO_2Cl_2-HCl system.** Yigui Li (Tsinghua Univ., Beijing, BJ (China)); Jiufang Lu; Xunan Zhou; Teng Teng. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow,

USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Solvent extraction thermodynamics in the system n-trioctylamine-toluene-UO_2CL_2-HCl-water was considered. Pitzer equation and improved Frank-Thompson equation were used to calculate coefficients of electrolyte activity in aqueous phase. Activity coefficients of all components in organic phase were measured or calculated. Thermodynamic equilibrium constants of studied system were obtained. 7 refs.

36861 (INIS-SU–97, pp. 131-134) **Equilibrium on metal extraction with substituted ammonium salts effect of non-ideality of the organic phase.** Ochkin, A.V. (Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR)). AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Consideration is given to equations, enabling to describe equilibrium in extractive systems, based on alkyl substituted ammonium salts (AAS) with allawance made for the effects of hydration, solvation and mutual influence of components in organic phase. These equations were used to analyze n-octanol effect on uranyl sulfate solvent extraction by tri-n-octylammonium sulfate solution in benzene. Quantitative estimation of alcohol effect on uranium distribution coefficient, as well as on decrease of hydration ratio of extractant due to AAS solvation by n-octanol is given. Calculation of decrease of the molar activity coefficient of extracted complex in AAS presence is considered for solvent extraction of cerium and europium nitrates by tridodecylammonium nitrate. 7 refs.; 1 tab.

36862 (INIS-SU–97, pp. 199-202) **Complexation and extraction of halogenoacetates in ternary systems salt-water-extractant.** Baluev, A.V. (Radievyj Inst., Leningrad (USSR)); Suglobova, I.G. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Consideration is given to results of investigations into uranyl halogenacetates, acetat and nitrate in ternary systems salt-water-extractant (diethyl ether or tributyl phosphate) at 25 deg C. Reciprocal solubility diagrams for uranyl salt systems are presented. Relationship between the character of phase diagram and anion properties at the fixed cation and extractant was revealed. Tendency to formation of the closed binodal curve correlates with hydration number and is connected with electron-donor ability. Deviations are explained satisfactorily by the difference in solvation numbers, which seems to be connected with steric effects. The data obtained show that relationship between anion characteristics and salt extraction ability is ambiguous. Edwards parameter should be used to obtain more accurate evaluations. 15 refs.; 4 figs.; 2 tabs.

36863 (INIS-SU–97, pp. 220-223) **Acceptor extraction of uranyl salts with mixtures of organophosphoric acids with neutral additives.** Torgov, V.G. (AN SSSR, Novosibirsk (USSR). Inst. Neorganicheskoj Khimii); Us, T.V.; Mikhajlov, V.A.; Stoyanov, Ye.S.; Drozdova, M.K.; Bogdanova, D.D. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Uranium solvent extraction by mixtures of organophosphoric acids (HX) with neutral additives (L) (phosphine oxides, sulfoxides, tbp) excibits, along with the widely known synergic effect at low HX saturation with uranium, a new synergic effect occurring after complete HX saturation. Three types of isotherms of uranyl salt extraction by benzene solutions of HX and mixtures of HX with L were revealed. Their forms depend on superposition of cation-exchange and noncation-exchange synergic effects. Similarity of synergic effect of acid and neutral mixture components during solvent extraction from diluted and concentrated solutions of uranyl salts testified to the same nature of these two effects; both of them are determined by acceptor properties of uranium atom in monomeric $UO_2(HX_2)_2$ and polymeric $(UO_2X_2)_n$ complexes. The established regularities were confirmed, when studying uranyl sulfate extraction by UO_2X_2 mixture with L. 2 refs.; 2 figs.; 1 tab.

36864 (INIS-SU–97, pp. 229-232) **Mechanism of extraction of uranium (6) by mixtures of phosphororganic extractants.** Skorovarov, D.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR)); Ul'yanov, V.S.; Meshcheryakov, N.M.; Lagutenkov, V.A.; Mikheev, M.V. AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Extraction of uranium (6) from sulfuric acid solutions by solution of D2EHPA-TBP(TOPO) mixture in CCl_4 was studied by NMR method (D2HPA-di-2-ethylhexylphosphoric acid, TBP-tributylphosphate, TOPO-trioctylphosphine oxide). It is shown that stability and stoichiometry of formed solvates depends largely on electron-donor ability of organophosphoric base (TBP or TOPO). The presence of neutral base in extractive system leads to blocking of the coordination center of free D2EHPA molecules, growth of the active acid concentration, assisting in additional solvation of uranyl D2EHP molecules and formation of $UO_2(D2EHP)_2$center dotnS type complexes. This results in extraction of additional U(6) quantities to organic phase. 2 refs.; 3 figs.

36865 (INIS-SU–97, pp. 256-259) **Some new developments in actinide solvent extraction systems.** Navratil, J.D. (New South Wales Univ., Kensington (Australia)). AN SSSR, Moscow (USSR). 1988. (CONF-8807136–: ISEC '88: international solvent extraction conference, Moscow, USSR, 18-24 Jul 1988). In *International solvent extraction conference. Vol. 1. Conference papers.* Order Number DE89012151/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Consideration is given to application of neutral and acid organophosphoric compounds, adsorbed on various natural and synthetic carriers, in extraction chromatography for separation and isolation of actinides. It is shown that trioctylphosphine oxide (TOPO) on a solid combustible carrier represents the promising material for plutonium extraction. It was established experimentally that polyurethane foam possessed the maximal capacity with respect to TOPO; extractant losses at that after passing of 50 column volumes of nitric acid don't exceed 2 %. 11 refs.; 1 tab.

4008 Combustion, Pyrolysis, and High-temperature Chemistry

Refer also to citation(s) 35687, 36442

36866 (AD-A–205059/9/XAB) **Suppression of soot in flames by alkaline-earth and other metal additives.** Bonczyk, P.A. United Technologies Research Center, East Hartford, CT (USA). 1988. 24p. Available from NTIS, PC A03/MF A01.

Pub. in Combustion Science and Technology, Vol. 59, No. 143-163(1988).

Experiments were performed to clarify the role of metallic fuel additives in relation to soot suppression in a well-defined laboratory-scale diffusion flame. Principal emphasis was given to three alkaline-earth metals; namely, Ba, Sr and Ca. The experiments included Cu, Sn, Li, Na and K as well, but only to the extent that the latter contributed to under standing the details of alkaline-earth behavior. The additives were in the form of aqueous solutions of salts of the preceding metals. The solutions were aspirated into the oxidant flow of a nearly two-dimensional laminar C_2H_4/air flame emanating from a symmetric Wolfhard-Parker burner. Soot size, number density, and volume fraction were determined from Mie scattering.

36867 (CONF-8807172–1) **Bifurcation and pattern formation in combustion.** Bayliss, A.; Matkowsky, B.J.; Minkoff, M. Argonne National Lab., IL (USA). 1988. 61p. Sponsored by DOE/ER;OGA. DOE Contract W-31109-ENG-38;FG02-87ER25027. From 10. Dundee conference on differential equations; Dundee, UK; 4-8 Jul

1988. Order Number DE89013629/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

In our research program we employ a combination of analytical and numerical methods to determine the behavior of solutions of combustion problems. Specifically we consider highly nonlinear time dependent systems of partial differential equations which model the behavior of both solid and gaseous fuel combustion. In gaseous fuel combustion we are particularly interested in the transition from laminar to turbulent combustion, including a description of the intermediate stages of this transition. We have developed an adaptive pseudo-spectral method which is both very accurate and very efficient. Our algorithm allows us to describe the solution on bifurcation branches, well beyond the region where analytical methods work well. We have however taken advantage of the analytical results that we first obtain, to aid us in choosing appropriate parameter values and initial conditions for the numerical computations. In addition the analytical results serve as benchmarks for our computations. The computations reveal new and interesting behavior, not otherwise obtainable. Below we discuss two problems, involving solid and gaseous fuel combustion respectively. 26 refs., 12 figs.

36868 (DOE/ER/13544–T2) **Laser spectroscopy and dynamics of combustion intermediates: Three year progress report, 1 June 1986–31 May 1989.** Clouthier, D.J. Kentucky Univ., Lexington, KY (USA). Dept. of Chemistry. Oct 1988. 10p. Sponsored by DOE Energy Research. DOE Contract FG05-86ER13544. Order Number DE89014498/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The research originally proposed under this grant concerned the study of the spectroscopy and excited state dynamics of a number of transient sulfur-containing molecules and free radicals. It was suggested that the identification and study of sulfur species which are analogs of important oxygen-containing combustion intermediates would be important to our understanding of reactive intermediates. The specific systems chosen for study were thioformaldehyde (H_2CS), thioketene (H_2CCS), disulfur monoxide (S_2O), and the free radical HCCS, C_2S and HCS. Since most of the species had not been previously studied by laser techniques and some of them were completely unknown, much effort has been devoted to determining methods for producing and observing them. We have been successful in a number of studies and have developed a new technique called pyrolysis jet spectroscopy which promises to be widely applicable. A detailed description of progress in each area is given. 14 refs.

42 ENGINEERING

4202 Facilities and Equipment

Refer also to citation(s) 35769, 35819, 35820, 35943, 36083, 36345, 36401, 36404, 36413, 36569, 36613, 36653, 36666, 36962, 36965, 36995, 36998, 37018, 37121, 37135, 37144, 37153, 37816

36869 (CONF-890721–14) **Cask drop testing and analysis.** Shappert, L.B. Oak Ridge National Lab., TN (USA). 1989. 5p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. From Joint ASME/JSME pressure vessel and piping conference; Honolulu, Hawaii, USA; 23-27 Jul 1989. Order Number DE89008921/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Packages designed to carry spent fuel within the United States must be approved and certified by the Nuclear Regulatory Commission (NRC). This is done by submitting an application to the NRC that describes the package design and provides a detailed technical evaluation of its performance under a variety of normal and accident conditions. These technical evaluations are often based on a combination of theoretical analysis and experimental testing that can be particularly important if it is necessary to corroborate specific analytical assumptions or confirm the methodology used. Tests can be applied to full-scale prototypes or scale model packages, either of which can frequently provide the necessary evidence to substantiate the conclusions. This report discusses two types of packages that were tested at the Oak Ridge National Laboratory – a scale model spent fuel cask and a full-scale canister designed to be carried inside a spent fuel cask. They were designed by two private companies. Both companies applied to the NRC for a Certificate of Compliance for their casks. In both cases, the combination of testing and analysis, and the way it was applied, formed a critical part of their application. 7 refs., 2 figs., 1 tab.

36870 (DOE/CE/15316–T3) **Laser based machine for die and prototype manufacturing: Final report, February 10, 1987–August 9, 1988.** Feygin, M. Hydronetics, Inc., Chicago, IL (USA). 5 Feb 1989. 17p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG01-87CE15316. Order Number DE89009115/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In his application to the Bureau of Energy Related Inventions Michael Feygin proposed a feasibility study for a new process aiming at completely automated manufacturing of complex and hard to manufacture parts. The technique invented by Michael Feygin is called Laminated Object Manufacturing. It utilizes thin cross-sections of a part, cut by a laser based contouring machine. The part is created by successive deposition and bonding of layers of material. Part geometry is specified by successive cross-sectioning of 3-dimensional images created with a CAD program on a graphic workstation. The Laminated Object Manufacturing system can be thought of as a "three-dimensional-printer" which incrementally stacks two-dimensional images. The ultimate hard copy is produced, the object itself. The laser system is basically an assembly of known technologies: laser cutting, CAD and CAM, brazing or adhesion bonding, and computer controlled mechanical handling of components. It offers a revolutionary new way to produce 3-dimensional objects such as molds, dies, prototypes, models and other items produced in small batches. The research performed on the grant created a foundation for building a successful prototype of a LOM system. The prototype has been built in 1988 using funds of the Illinois Innovation Fund, a state agency independent from DOE. 8 figs., 1 tab.

36871 (GA-A–19416) **GACAP: A new computer code for analysis of symmetric and nonsymmetric cask cross sections.** Shatoff, H.; Koploy, M. General Atomics, San Diego, CA (USA). Jun 1989. 11p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC07-88ID12698. (CONF-890631–54: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89014250/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

General Atomics (GA) is designing two legal weight truck casks to transport spent fuel for the Office of Civilian Waste Management. Regulations in 10CFR71 require that they be evaluated for impacts on unyielding surfaces for normal transport and hypothetical accident conditions. To analyze the impacts of the casks, GA developed a new two-dimensional dynamic computer code capable of evaluating the dynamic response of symmetric and nonsymmetric casks during impacts. The code utilizes lumped masses with elastic beams to model the cask structure. It assumes small deformations in the cask structure and performs an explicit step-by-step integration using the central difference method. Load versus deflection tables represent the variation of in-plane cask angles of impact along with the rotated position of the cask axis. The code performs a two-way interpolation of the tables for intermediate angles. Impact forces are always normal to the impact plane. The user controls the location of the impact forces along with the effect of friction at impact. The user also has control of the amount of shear deformation allowed in the beams. Multiple beam cross sections can be imposed in the same segment. The user can either have the code calculate the properties of circular or rounded corner box sections or can input direct stiffness properties. The input is all in free format and very user friendly. 2 refs., 5 figs., 1 tab.

36872 (INIS-SU–84/A) **Design and construction. Scientific-technical collection.** Voprosy atomnoj nauki i tekhniki. no. 3. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. 86p. (In Russian). Order Number

DE89012163/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Individual papers in this collection are indexed separately.

36873 (INIS-SU–84/A, pp. 67-73) **Non-standard means of mechanization for auxiliary and repair operations.** Polunin, G.V.; Shvetsov, B.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). In *Design and construction. Scientific-technical collection.* Order Number DE89012163/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

Brief description, field of application and recommendations on the choice of non-standard equipment for mechanization of auxiliary and repair operations are presented. 5 figs.

36874 (INIS-SU–84/A, pp. 47-51) **Standardization and series production of radiation-shielding items.** Shcherbenok, G.U. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). In *Design and construction. Scientific-technical collection.* Order Number DE89012163/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

Problems of standardization, design and production of radiation-shielding items are considered. Radiation-shielding items include systems and means providing for operation safety under harmful effects of ionizing radiation and radioactive substances on a person and prevention of possible environment contamination by radioactive substances according to permissible normals and rules. 5 refs.; 1 tab.

36875 (INIS-SU–84/A, pp. 52-56) **Recharging container.** Pronin, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). In *Design and construction. Scientific-technical collection.* Order Number DE89012163/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

Consideration is given to a design of recharging container, designated for transportation of γ-active samples in a chain of cameras. Permissible activity in the container is 100 radium equivalent (at E_γ=1.25 MeV), thickness of biological shielding (for lead) is 200 mm. Overall dimensions: diameter-950 mm, heigh-2060 mm. Container mass is 7800 kg. The container provides for high reliability of maintenance and adjustment. 3 figs.

36876 (INIS-SU–84/A, pp. 57-66) **Chamber for storage and recharging.** Sinitsyn, O.A.; Kopylov, V.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). In *Design and construction. Stientific-technical collection.* Order Number DE89012163/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

Chamber for recharging sealed sources of ionizing radiations from transport containers to technological ones and devices, as well as for intermediate source storage is described. 3 refs.; 4 figs.

36877 (INIS-SU–86/A, pp. 24-26) **Hydrogen isotopes effect on efficiency of helium cryosorption pumping out by argon condensed layers.** Rabin, A.A.; Svishchev, V.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Thermonuclear synthesis. Scientific-technical collection.* Order Number DE89012166/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

The effect of hydrogen (H_2 and D_2) isotopes on the efficiency of helium cryosorptional pumping out by argon layers, condensed at the temperature of 4.2 and 2 K is investigated. Dependences of helium adhesion coefficients ν_{He} on the value of its concentration in sorbent layer for different amounts of preliminarily adsorbed H_2 and D_2 also in case of hydrogen-helium mixture pumping out are obtained. In case of T=4.2 K the differences in the effect of H_2 and D_2 on the value of ν_{He} are insignificant and stay within measurement error, for D_2 a weaker effect at T=2 K is detected. Results of the work confirm the necessity of separate pumping out of hydrogen and helium by the use of cryosorption on the layers of condenced gases in a thermonuclear reactor and permit to determine admissible amounts of hydrogen in the pumped out mixture and in the layer of sorbent without noticeable deterioration of pumping-out properties as regards helium. 7 refs.; 3 figs.

36878 (LA-UR–89-2138) **Prototype testing for a hybrid gas-gun/railgun device.** Parker, J.V. Los Alamos National Lab., NM (USA). 1989. 19p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890710–11: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014294/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In 1984 Los Alamos began the design of the lethality test system (LTS), a facility to be used for the study of impact physics at velocities up to 15 km/s. The key component of LTS was an electromagnetic launcher capable of accelerating a 30 gram mass to 15 km/s. By the time of the Preliminary Design Review (July 1985) it was known from laboratory experiments that a conventional railgun was incapable of reaching 15 km/s starting at low velocity (~1 km/s) and a hybrid design was adopted for the LTS launcher. The hybrid launcher consisted of a two-stage hydrogen gun that preaccelerated the test mass to 6.5 km/s and an electromagnetic launcher for the final acceleration from 6.5 to 15 km/s. Design calculations predicted that injection into the railgun at 6.5 km/s would reduce ablation sufficiently to permit operation at 12 km/s with reasonable probability of achieving 15 km/s. The hybrid launcher design adopted for LTS presents some unique mechanical and electrical issues. In particular, the hybrid design requires that the plasma armature be established in a high pressure gas environment behind the projectile. To address this issue, as well as to evaluate the mechanical and electrical design, an 1.83 meter long prototype of the electromagnetic launcher barrel was built and tested. This paper describes the prototype launcher tests and the performance achieved. In addition, testing of a plasma initiator operating in a high pressure gas environment is discussed. 5 refs., 11 figs., 1 tab.

36879 (MLM–3597) **Computer aided process planning conceptual design and functional specification.** Burke, J.A. EG and G Mound Applied Technologies, Miamisburg, OH (USA). 23 Jun 1989. 22p. Sponsored by DOE Defense Programs. DOE Contract AC04-88DP43495. Order Number DE89013738/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document is a compilation of Mound's research effort to define computer aided process planning, a system that will automate the function of creating, maintaining, and using manufacturing documentation or process plans. Studies show that the implementation of this system will require the redefinition of engineering functions and practices. It will also require a system to automate and integrate these activities into the existing capabilities and expected paybacks are discussed. Finally, some implementation issues are pointed out for further evaluation and consideration at a future time. 3 figs., 1 tab.

36880 (ORNL–6525) **Oak Ridge National Laboratory Health and Safety Long-Range Plan: Fiscal years 1989–1995.** Oak Ridge National Lab., TN (USA). Jun 1989. 189p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014570/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The health and safety of its personnel is the first concern of ORNL and its management. The ORNL Health and Safety Program has the responsibility for ensuring the health and safety of all individuals assigned to ORNL activities. This document outlines the principal

aspects of the ORNL Health and Safety Long-Range Plan and provides a framework for management use in the future development of the health and safety program. Each section of this document is dedicated to one of the health and safety functions (i.e., health physics, industrial hygiene, occupational medicine, industrial safety, nuclear criticality safety, nuclear facility safety, transportation safety, fire protection, and emergency preparedness). Each section includes functional mission and objectives, program requirements and status, a summary of program needs, and program data and funding summary. Highlights of FY 1988 are included.

36881 (SAND–88-3057C) **Damage predictions for wind turbine components using the LIFE2 computer code.** Sutherland, H.J. Sandia National Labs., Albuquerque, NM (USA). 1989. 6p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890717–1: European wind energy conference and exhibition, Glasgow, UK, 10-13 Jul 1989). Order Number DE89013813/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The LIFE2 computer code is a fatigue/fracture analysis code that is specialized to the analysis of wind turbine components. It is a PC-compatible FORTRAN code that is written in a top-down modular format. The service lifetime of a component can be divided into three phases: crack initiation, growth and coalescence of microcracks and growth of a macro-crack. In the LIFE2 formulation, a "S-n fatigue" analysis is used to describe the first two phases and a linear, "da/dn" fracture analysis is used to describe the third phase. The code is divided into five main sections. The first four describe the wind resource, the constitutive properties of the turbine material, the stress state in which the turbine operates and operational parameters for the turbine system. The fifth uses the data files written by the first four sections to calculate the service lifetime of a turbine component. In addition to the main sections, auxiliary sections are included to permit the storage of data and code calculations and to permit the plotting of results. This report describes the computational framework used in the LIFE2 code to evaluate the damage rules cited above. An example problem is presented here to illustrate the capabilities of the code.

36882 (SAND–88-3169C) **Jitter improvement of the 12-MV oil switches on Aurora.** Warren, F.T.; Hammon, H.G.; Turman, B.N.; Prestwich, K.R. Sandia National Labs., Albuquerque, NM (USA). 1989. 20p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890665–19: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89013809/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Aurora Prompt Gamma Flash Simulator has been undergoing a series of machine upgrades in response to recent simulation requirements. One outgrowth of these new requirements is the need for improved synchronization of the four Blumlein modules. Physics International and Sandia National Laboratories have developed and tested an innovative oil-switch trigger scheme consisting of a charged transmission line pulse generator switched by a 3-MV, electrically-triggered, Rimfire gas switch. Recently, we have tested the oil switch trigger pulser on one of the 12-MV, Blumlein oil switches. In these tests, we have achieved shot-to-shot jitter of 5 ns. By comparison, jitter of the present trigger scheme has been measured to be 10 ns. In this paper, we will discuss the jitter-reduction techniques, the design of the low-jitter, oil switch trigger pulser, and the tests results achieved on Aurora. 9 refs., 9 figs., 3 tabs.

36883 (SAND–88-3271) **TRUPACT I filter development: Status report.** Kincy, M.A.; Joseph, B.J.; Humphreys, D.L. Sandia National Labs., Albuquerque, NM (USA). Jun 1989. 66p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (TTC–0891). Order Number DE89014573/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report describes the development of the TRUPACT-I Filtered Pressure Equalization System (FPES). The approach taken in establishing performance requirements for the FPES and the results of the qualification tests are presented. 15 refs., 39 figs., 4 tabs.

36884 (SAND–88-8934) **Development of a thin wall graphite/polyimide composite pressure vessel with a large aspect ratio.** LaJeunesse, C.A.; Trinh, K.V.; Bartel, J.J.; Spingarn, J.R. Sandia National Labs., Albuquerque, NM (USA). Oct 1988. 32p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DR00789. (CONF-890721–1: Joint ASME/JSME pressure vessel and piping conference, Honolulu, Hawaii, USA, 23-27 Jul 1989). Order Number DE89002536/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A graphite/polyimide composite pressure vessel has been developed to contain corrosive gas mixtures up to 400 psig and 300°F. The goal of this research project was to develop a lightweight, thin-walled, composite pressure vessel with an l/d aspect ratio of 42 capable of containing hydrogen fluoride (HF) and chlorine trifluoride (ClF_3). The vessel was to have a crown radius approaching infinity, a desired knuckle radius approaching zero, and a desired wall thickness of 0.023 in. In this paper the problems encountered and the iterative solutions in addition to the design, analysis, and fabrication of the vessel are presented. 3 refs., 14 figs., 2 tabs.

36885 (SAND–88-8935) **Nonlinear dynamic response of pressurized composite bottles subjected to shock loading.** Trinh, K.V.; Weingarten, L.I. Sandia National Labs., Livermore, CA (USA). Mar 1989. 29p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DR00789. (CONF-890721–26: Joint ASME/JSME pressure vessel and piping conference, Honolulu, Hawaii, USA, 23-27 Jul 1989). Order Number DE89010553/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A combined experimental and analytical program has been developed to examine the structural dynamic response of pressurized composite bottles subjected to spatially localized loadings. These bottles were constructed from graphite/epoxy, Kevlar/epoxy and fiberglass/epoxy. Some bottles also contained mock solid propellant. The impulsive, exponentially decaying shock loads were applied using blast tube techniques. Dynamic response analyses of the bottles were performed using the finite element code ABAQUS. A damage model was developed to account for material degradations due to the progressive failures of the composite material. The report presents the comparisons between results obtained from experiments and analytical methods. 3 refs., 11 figs., 5 tabs.

36886 (SAND–89-1113C) **Design of an advanced entry control system.** Williams, J.S.; Miller, D.W. Sandia National Labs., Albuquerque, NM (USA). 1989. 6p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–7: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, FL, USA, 9-12 Jul 1989). Order Number DE89014781/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An entry control system (ECS) allows the movement of authorized personnel and material through normal routes while detecting and delaying movement of unauthorized personnel and contraband. This paper presents an overview of several unique design and operating principles used in the implementation of a positive identity entry control system utilizing proximity cards. The system design incorporates distributed processing to support geographically separated entry points and redundancy such that no single point failure will shut down operations. The functionality and integration of the photo identification system, the visitor authorization system, and the access control and contraband detection systems will be discussed. Systems unique features such as temporary badge issue for lost or forgotten badges at entry points using video lookup, visitor processing, and ergonomic and environmental considerations for the design of the proximity card based entry lane will be covered. 6 figs.

36887 (SAND–89-1212C) **A wind shielded fire test facility.** Keltner, N.R.; Kent, L.A. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–53: International symposium on packaging and transporting of radioactive materials, Washington, DC, USA, 11-16 Jun 1989). Order Number DE89014483/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Sandia National Laboratories has utilized pool fires to subject military components and radioactive material shipping containers to postulated transportation accident environments for over thirty years. Because these are usually very high value items, there is typically a single fire test. Because wind produces the biggest, uncontrollable effect on the thermal environment of open pool fires,

there is a risk of an invalid test if winds develop during the test. For example, IAEA regulations specify the average speed must be less than 2 m/s. To reduce weather related risks during small fire tests, several wind shielded test facilities have been developed. In developing these facilities, it was necessary to demonstrate that they closely simulated the environment in a large open pool fire. Recently, a project was undertaken to develop a new facility that could reproduce the thermal environment of an open pool fire and comply with air quality regulations. The design of the facility is based on a scale-up of an existing facility that was used to develop methods for reducing emissions while maintaining the appropriate thermal conditions. 5 refs., 5 figs.

36888 (SAND–89-1312C) **Investigation of cask contamination weeping: A progress report.** Bennett, P.C. Sandia National Labs., Albuquerque, NM (USA). 1989. 11p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8904225–1: IAEA Technical Committee meeting on decontamination of transport casks and spent fuel storage facilities, Vienna, Austria, 4-7 Apr 1989). Order Number DE89013492/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Spent fuel transportation casks have arrived at final destinations with removable surface contamination levels in excess of regulatory limits, although pre-transport surveys indicated removable contamination levels were well below these limits. The control of this in-transit "weeping" of surface contamination on pool-loaded spent fuel transport casks is of particular concern to both the US Department of Energy (DOE) and the US Nuclear Regulatory Commission (NRC). Weeping, also known as sweating, is the transformation of fixed radioactive particulates on an exterior surface of transport cask to a removable state. Weeping has been observed sometime after a cask is removed from a fuel pool and decontaminated. The weeping phenomenon is countered by time-consuming operational constraints and procedures which have a significant impact on cask turnaround times and occupational exposures at transport facilities. Further, the arrival of a contaminated cask results in negative public perceptions that are inconsistent with DOE and NRC goals. The objectives in resolving the technical issue of weeping are to identify specific causes of the weeping phenomenon, then to implement new cask design requirements and supporting operational procedures which will limit or inhibit the accumulation, retention, and in-transit conversion of fixed surface contamination. 6 figs., 1 tab.

36889 (SAND–89-1402) **Numerical analysis of designs to reduce the kinetic energy of Davis Gun pusher plates.** Young, E.R.; Norwood, F.R. Sandia National Labs., Albuquerque, NM (USA). Apr 1989. 50p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89014571/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Computer simulations, using the hydrocode HULL, were performed to analyze a method to discard the sabot and the effectiveness of several designs in reducing the kinetic energy of pusher plates for Davis Gun systems. This study assumed an axisymmetric impact of the pusher plate on one metal and multi-metal annual plates. Based on these simulations, a four petal sabot that is mechanically attached to the penetrator and an aluminum-steel composite target plate are recommended. 12 refs., 27 figs.

36890 (SAND–89-1587C) **TRACE - Tamper Resistant Authenticated Camera Enclosure.** Skogmo, D. Sandia National Labs., Albuquerque, NM (USA). 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–20: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, FL, USA, 9-12 Jul 1989). Order Number DE89014186/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

To protect a security instrument such as a television camera from subversion by signal substitution, the data from the instrument are digitized and submitted to an authenticator. The digital data may then be transmitted in the clear over a non-secure medium. Appended to the data is a 10-bit authentication value based on the values of the data and a random authentication number. At the receiving end, the data are submitted to an identical authenticator. If it produces the same authentication value, the data are authentic. Such a scheme can only work if the instrument, the authenticator, and the link between them can be protected from tampering. This paper describes a tamper resistant container designed to protect a data authenticator and television camera against an adversary having sophisticated resources and complete design information. The container's design includes active elements to detect and report intrusion attempts in real time. It also includes passive elements to indicate upon later inspection that the container had been violated. 1 ref., 2 figs.

36891 (SAND–89-1594C) **The PVF2 piezoelectric polymer shock stress sensor: System characterization for application under field test conditions.** Reed, R.P.; Greenwoll, J.I. Sandia National Labs., Albuquerque, NM (USA). 1989. 24p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8906133–3: 15. transducer workshop, Cocoa Beach, FL, USA, 20-22 Jun 1989). Order Number DE89014629/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The piezoelectric polymer, polyvinylidene di-fluoride (PVDF or PVF2), properly processed by the proprietary Bauer technique, is a material for a transducing element that can be used for a wide variety of stress, pressure, or temperature related measurements. Its versatility as a sensor requires especially careful attention to the special requirements for associated gauge packaging, installation, signal conditioning, recording, and analysis that are imposed by the particular diverse test conditions. Most applications reported to date have been for tests performed under laboratory conditions. But, the PVDF sensor has also been successfully used for stress wave measurement under adverse and often hostile field test conditions that require the use of lengthy transmission lines and allow only limited recording capability. This paper discusses one crucial aspect of field application – measuring system characterization, and correction of signals distorted by systems of marginal frequency capability. 11 refs., 7 figs.

36892 (SAND–89-1616C) **Field evaluation of new exterior video motion detection systems.** Malone, T.P. Sandia National Labs., Albuquerque, NM (USA). 1989. 23p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–25: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, FL, USA, 9-12 Jul 1989). Order Number DE89014515/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Considerable interest has been generated within the past several years concerning the use of new generation video motion detection (VMD) systems as exterior intrusion sensors. The new generation VMD systems advertise advanced video signal processing techniques and algorithms which are aimed at rejecting nuisance alarm sources inherent to the uncontrolled exterior environment. Older generation VMD systems used in an exterior environment tend to have high nuisance alarm rates. The high nuisance alarm rates of the older systems made them generally unacceptable for use as an exterior sensor. This paper discusses the results of continued field testing of new generation VMD systems. Field tests were conduced in an exterior perimeter zone application and an application looking at the exterior entrance of a building. Test results include each VMD system's detection capabilities and nuisance alarm characteristics for each particular application. Also site considerations such as lighting, cameras and zone layouts for exterior video motion detection are discussed. 1 ref., 14 figs., 1 tab.

36893 (UCID–19592-Rev.5) **DYNA3D user's manual: (Nonlinear dynamic analysis of structures in three dimensions): Revision 5.** Hallquist, J.O.; Whirley, R.G. Lawrence Livermore National Lab., CA (USA). May 1989. 201p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89014304/JAW. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

This report provides an updated user's manual for DYNA3D, an explicit three-dimensional finite element code for analyzing the large deformation response of inelastic solids and structures. A contact-impact algorithm permits gaps and sliding along material interfaces with friction. Using a specialization of this algorithm, such interfaces can be rigidly tied to admit variable zoning without the need of transition regions. Spatial discretization is achieved by the use of 8-node solid elements, 2-node beam elements, 4-node shell elements, 8-node solid shell elements, and rigid bodies. The equations-of-motion are integrated in time by the central difference method. The

1989 version of DYNA3D contains thirty material models and ten equations of state to cover a wide range of material behavior.

36894 (UCRL–100757) **The analysis of lead slump effects in shipping casks for radioactive materials.** Mok, G.C.; Chun, R.C.; Lo, T.Y.; Witte, M.C. Lawrence Livermore National Lab., CA (USA). Mar 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890721–18: Joint ASME/JSME pressure vessel and piping conference, Honolulu, Hawaii, USA, 23-27 Jul 1989). Order Number DE89009952/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Lead shields are commonly used to control the radiation of packages containing radioactive materials. Having low strength, the shields deform easily under loads, therefore losing their capability to control radiation. This paper examines this problem for a circular cylindrical shipping cask, whose lead shield is encased between two steel cylinders. To this end, the paper describes the deformation of the lead shield under impact loads and its effects on the shielding capability and on the stresses in the steel cylinders. The paper details a simplified mathematical theory for the quantitative evaluation of these effects. The validity of the theory is demonstrated by comparing the numerical results of this method to those of tests and sophisticated finite-element analyses. The method has been implemented in a computer program, called SCANS (Shipping Cask ANalysis System), for shipping cask analysis. Developed for the US Nuclear Regulatory Commission and the Department of Energy, the program may be obtained from the Argonne National Software Center. 7 refs., 8 figs., 5 tabs.

36895 Superconducting Magnetic Energy Storage. Hassenzahl, W. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 750-758 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

Recent programmatic developments in Superconducting Magnetic Energy Storage (SMES) have prompted renewed and widespread interest in this field. In mid 1987 the Defense Nuclear Agency, acting for the Strategic Defense Initiative Office issued a request for proposals for the design and construction of SMES Engineering Test Model (ETM). Two teams, one led by Bechtel and the other by Ebasco, are now engaged in the first phase of the development of a 10 to 20 MWhr ETM. This report presents the rationale for energy storage on utility systems, describes the general technology of SMES, and explains the chronological development of the technology. The present ETM program is outlined; details of the two projects for ETM development are described in other papers in these proceedings. The impact of high Tc materials on SMES is discussed.

36896 CEBAF, a large scale application of superconducting rf. Chargin, A.K. (CEBAF (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 769 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The Continuous Electron Beam Accelerator Facility (CEBAF) is a 4 GeV, multipass, CW accelerator. The machine is racetrack shaped with the linac split into two equal parts located in the straight sections. The recirculating magnets, which will guide the beam through four passes around the accelerating structure, are in the arc sections connecting the two linacs. At the end of the accelerator, the beam passes into the switchyard where it is guided into any of three experimental end stations. The linac consists of 418 Nb superconducting rf cavities operating at 1500 MHz to produce a high quality beam having a 100% duty cycle with an energy spread of 10^{-4} and emittance of 10^{-9} m. The operating temperature of the linac is 2K, based on a cost trade off between increasing rf heat loads with an increase in temperature, and an increasing cost of refrigeration to decrease temperature. A pair of High Resolution Spectrometers in Hall A and a high acceptance, high energy electron spectrometer in Hall C will utilize superconducting dipoles and quadrupoles. The Large Acceptance Spectrometer in Hall B is a six coil superconducting toroid.

36897 Flux noise and flux creep in YBCO thin films. Ferrari, M.J. (Dept. of Physics, Univ. of California, Lawrence Berkeley Lab., Berkeley, CA (US)); Johnson, M.; Wellstood, F.C.; Clarke, J.; Rosenthal, P.A.; Hammond, R.H.; Beasley, M.R. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 806-889 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The authors have a dc SQUID to measure the low-frequency magnetic flux noise produced by thin-film rings of $YBa_{p2}Cu_3O_{7-\delta}$ (YBCO) with various microstructures. Below the transition temperature T_c of the YBCO, the spectral density of the noise scales as 1/f (f is the frequency) from 1 Hz to 1 kHz. This noise generally increases with temperature and vanishes abruptly at T_c. Improvements in crystalline microstructure dramatically reduce the magnitude of the noise, which was lowest for a highly oriented sample with its c-axis perpendicular to the substrate. Making a radial cut to interrupt current paths around the sample ring does not significantly affect the magnitude of the noise, demonstrating that the noise arises from a local mechanism such as the thermally activated hopping of flux bundles. Flux creep was observed in one sample cooled in a magnetic field of 1 mT, and the creep rate exhibited a sharp maximum near 80 K. The authors conclude that SQUIDs and flux transformers of YBCO must be fabricated from highly oriented films to obtain low noise at low frequencies.

36898 Single superconducting thin film devices for applications in high T_c materials circuits. Martens, J.S. (Univ. of Wisconsin-Madison, Dept. of Electrical and Computer Engineering, Madison, WI (US)); Beyer, J.B.; Nordman, J.E.; Ginley, D.S.; Hohenwarter, G.K.G.; McGinnis, D.P. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 954-956 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The authors have investigated several different devices based on regions of weak superconductivity and multiple parallel links in thin films. Hysteretic symmetric and asymmetric IV curves have been observed. Flux flow was indicated. Device switching properties and the dependence of the flux flow signature in the IV curve on applied magnetic field were explored. Both Nb and high T_c thin films were used in circuit fabrication. Contrary to vortex flow devices based on Josephson junctions those described here do not possess a tunneling barrier and are made of only a single superconducting layer. Hence they should be applicable to electronic circuits based on high T_c superconducting materials without the need for tunnel junctions.

36899 Characterization of YBaCuO and ErBaCuO thin films deposited on silicon and gallium arsenide substrates. Chin, D.K. (Dept. of Electrical Engineering and Computer Science and the Electronics Research Lab., Univ. of California, Berkeley, CA (US)); VanDuzer, T.; Hansen, W.L.; Yu, K.M.; Stickle, W.F.; Lee, S.Y.; Murdock, B. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 961-964 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

YBaCuO and ErBaCuO films have been deposited on Si substrates with and without a ZrO_2 buffer layer and on GaAs substrates by RF diode sputtering from stoichiometric oxide targets. The films and interface between the films and semiconductor substrates are analyzed by Rutherford backscattering spectrometry (RBS), X-ray fluorescence spectroscopy (XRF), Auger electron spectroscopy (AES), energy dispersive X-ray spectrometry (EDAX), and scanning electron microscopy (SEM). The films grown on Si substrates with a ZrO_2 buffer layer show superconductivity above 65 K and no significant interaction at the interface is observed. High-T_c films can be obtained either by slow furnace annealing or by rapid heat-pulse annealing. No significant interaction is observed between YBaCuO (ErBaCuO) and GaAs after rapid thermal annealing at temperatures below 750^0C.

36900 Low frequency resistance fluctuations in films of high temperature superconductors. Rosenthal, P. (Dept. of Applied Physics, Stanford Univ., Stanford, CA (US)); Hammond, R.H.; Beasley, M.R.; Leoni, R.; Lerch, P.; Clarke, J. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 973-975 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

Low frequency voltage fluctuations in thin films of $YBa_2Cu_cO_{7-x}$ at and above the superconducting transition have a spectral density $S_v(f)$ proportional to V-bar^2/f, where V-bar is the average voltage across the film and f is the frequency. The value of $S_v(f)$/V-bar^2 decreases markedly as the microstructure of the films is improved. In contrast to classic superconductors, the noise at the resistive transition does not arise from equilibrium temperature fluctuations.

36901 A film transmission line resonator to measure the microwave surface resistance of $YBa_2Cu_3O_{7-x}$. Martens, J.S. (Dept. of Electrical and Computer Engineering, Univ. of Wisconsin-Madison, Madison, WI (US)); Hohenwarter, G.K.G.; Beyer, J.B.; McGinnis, D.P.; Ginley, D.S. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 984-986 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The authors have constructed microstrip transmission line resonators with $YBA_2Cu_3O_{6.9}$ ground planes, SiO dielectric and Nb top conductors. The film resonator is a low impedance section $n\lambda/2$ long, and the wave is launched from a coax line. Loose coupling is provided by the discontinuity between 50 Ω feed lines and the .05 Ω resonator section. After de-embedding the transmittance data of the structure, the surface resistance of the ceramic superconductor can be computed. The surface resistance of $YBa_2Cu_3O_{6.9}$ at 4.2K was about a factor of 60 higher than that of theoretical Nb at 4.2K over the range of 2.9-6 GHz. The power law behavior versus frequency of the surface resistance is roughly quadratic as is consistent with two-fluid analysis.

36902 RF electromagnetic investigation of an $YBa_2Cu_3O_7$ thin film by proximity coupling. Baum, H.P. (Physics Dept., Univ. of Wisconsin-Milwaukee, Milwaukee, WI (US)); Schenstrom, A.; Zheng, Y.; Sarma, B.K.; Levy, M.; Kang, J.H.; Kampwipth, R.T. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 987-989 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The authors report here an investigation of the RF electromagnetic (e-m) attenuation by a $YBa_2Cu_3O_7$ thin film at 1 GHz, as a function of temperature. An increase in the RF e-m attenuation was observed as the temperature was decreased below the superconducting transition temperature $T_c \simeq 84$ K, followed by a rapid decrease at lower temperature (–25 K). A theoretical analysis of e-m absorption is evoked to compare it with the experimental results.

36903 Hot electron effect in the dc SQUID. Wellstood, F.C. (Dept. of Physics, Univ. of California, and Materials and Chemical Sciences Div., Lawrence Berkeley Lab., Berkeley, CA (US)); Clarke, J.; Urbina, C. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1001-1004 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The authors have investigated the temperature dependence of the noise in thin-film dc Superconducting Quantum Interference Devices (SQUIDs) down to 20 mK. The white noise measured in the early versions of our SQUIDs did not decrease as the bath temperature was lowered below 150 mK. They have attributed this saturation to a hot electron effect in the thin-film AuCu resistors shunting the Josephson junctions. A theoretical investigation showed that the temperature of the electrons in the shunts should be given by $T_e = (P/\Sigma\Omega)^{1}5/$, where P is the power dissipated in the shunts, Ω is the shunt volume, and Σ is a proportionality constant. Experimentally, the authors found $\Sigma=(2.4\pm0.6)X10^9WK^{-5}m^{-3}$. They have redesigned the shunts, adding large thin-film cooling fins, to increase their volume substantially. This technique has reduced T_e to about 50 mK, with a corresponding improvement in the sensitivity of the SQUIDs.

36904 Design of variable phase velocity kinetic inductance delay lines and their measured characteristics when fabricated by a simple Nb based process. Martens, J.S. (Dept. of Electrical and Computer Engineering, Univ. of Wisconsin-Madison, Madison, WI (US)); Beyer, J.B.; Nordman, J.E.; Hohenwarter, G.K.G.; McGinnis, D.P. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1100-1103 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

A simple design of superconducting kinetic inductance delay lines is presented. Delay lines were fabricated with a thin-film process involving only dc magnetron deposition and anodization of Nb. Phase velocity measurements demonstrated wave slowing to less than 1/150 of the velocity of light in free space with associated impedances in the Ohm range. Phae velocity changes on lines which were in physical proximity of long Josephson junctions and normal conducting lines were investigated. Variations larger than 10% of the equilibrium value were observed with junction coupled lines under bias application. Locally heated lines exhibited changes exceeding a factor of two. Loss and phase velocity were determined as a function of bias conditions in both cases.

36905 Nuclear magnetic resonance with dc SQUID preamplifiers. Fan, N.Q. (Dept. of Physics, Univ. of California, and Materials and Chemical Sciences Div., Lawrence Berkeley Lab., Berkeley, CA (US)); Heaney, M.B.; Clarke, J.; Newitt, D.; Wald, L.L.; Hahn, E.L.; Bielecki, A.; Pines, A. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1193-1199 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

Sensitive radio-frequency (rf) amplifiers based on dc Superconducting QUantum Intererference Devices (SQUIDSs) are available for frequencies up to 200 MHz. At 4.2 K, the gain and noise temperature of a typical tuned amplifier are 18.6±0.5 dB and 1.7±0.5 K at 93 MHz. These amplifiers are being applied to a series of novel experiments on nuclear magnetic resonance (NMR) and nuclear quadrupole resonance (NQR). The high sensitivity of these amplifiers was demonstrated in the observation of nuclear spin noise, the emission of photons by ^{35}Cl nuclei in a state of zero polarization. In the more conventional experiments in which one applies a large rf pulse to the spins, a Q-spoiler, consisting of a series array of Josephson junctions, is used to reduce the Q of the input circuit to a very low value during the pulse. The Q-spoiler enables the circuit to recover quickly after the pulse, and has been used in an NQR experiment to achieve a sensitivity of about 2×10^{16} nuclear Bohr magnetons in a single free precession signal with a bandwidth of 10 kHz. In a third experiment, a sample containing ^{35}Cl nuclei was placed in a capacitor and the signal detected electrically using a tuned SQUID amplifier and Q-spoiler. In this way, the electrical polarization induced by the precessing Cl nuclear quadrupole moments was detected: this is the inverse of the Stark effect in NQR. Two experiments involving NMR have been carried out. In the first, the 30 MHz resonance in ^{119}Sn nuclei is detected with a tuned amplifier and Q-spoiler, and a single pulse resolution of 10^{18} nuclear Bohr magnetons in a bandwidth of 25 kHz has been achieved. For the second, a low frequency NMR system has been developed that uses an untuned input circuit coupled to the SQUID. The resonance in ^{195}Pt nuclei has been observed at 55 kHz in a field of 60 gauss.

36906 Chaos and catastrophe near the plasma frequency in the rf-biased Josephson junction. Kautz, R.L. (4435000); Monaco, R. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1399-1403 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

At bias frequencies much higher than the plasma frequency, the zero-voltage state of the rf-biased Josephson junction is known to span a range of dc bias proportional to the zero-order Bessel function of the rf amplitude. This pattern is modified at frequencies near the plasma frequency by the onset of chaotic instabilities and by the presence of cusp catastrophes.

36907 The design of a high field Ohmic heating coil for a superconducting tokamak, based on the US-DPC test coil. Hoenig, M.O. (9510048); Steeves, M.M. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1481-1483 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The fabrication of the US-DPC test coil in the US is using industrial processes capable of manufacturing advanced 30 to 40 κA ternary Nb_3Sn cable-in-conduit (CICC) conductors and coils for compact, high field tokamaks. This paper examine the feasibility of 1 to 2 m bore 15 T Ohmic Heating (OH) coils using state of the art

CICC conductors. The proof of concept of this technology should be confirmed in the 1990 US-DPC tests at the Japanese Demonstration Poloidal Coil Test Facility (DPCF). While this technology has yet to be demonstrated, the OH coil design concepts presented in this paper appear to satisfy all known superconducting, magnetic, pulsed loss, structural, hydraulic, thermodynamic, as well as economic requirements of an ohmic heating central solenoid for a compact steady state tokamak.

36908 Test results from recent 1.8-M SSC model dipoles. Wanderer, P. (0936000); Cottingham, J.G.; Dahl, P.; Garber, M.; Ghosh, A.; Goodzeit, C.; Greene, A.; Herrera, J.; Kahn, S.; Kelly, E. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1451-1454 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The authors report results from four 1.8 m-long dipoles built as part of the Superconducting Super Collider (SSC) R and D program. Except for length, these models have the features of the SSC design, which is based on a two-layer cosine theta coil with 4cm aperture. As compared to the 17 m design length SSC dipoles, these 1.8m magnets are a faster and more economical way of testing design changes in field shape, conductor support in the coil straight-section and ends, etc. The four magnets reported here all reach fields in excess of 7.5T with little training and have excellent field shape.

36909 Magnet systems for the international thermonuclear experimental reactor. Henning, C.D. (9513035); Miller, J.R. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1469-1472 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The definition phase for the International Thermonuclear Experimental Reactor (ITER) has been nearly completed, thus beginning a three-year design effort by teams from the European Community (EC), Japan, U.S., and USSR. Preliminary parameters for the superconducting magnet system have been established to guide more detailed design work. Radiation tolerance of the superconductors and insulators has been important because it sets requirements for the neutron-shield dimension and sensitively influences reactor size. Major levels of mechanical stress appear in the structural cases of the inboard legs of the toroidal-field (TF) coils. The winding packs of the TF coils include significant fractions of steel that provide support against in-plane separating loads, but they offer little support against out-of-plane loads unless shear-bonding of the conductors can be maintained. Heat removal from nuclear and ac loads has not limited the fundamental design, but it has nonnegligible economic consequences.

36910 Status of the SSC superconducting magnet program. Peoples, J. (9513034). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1444-1450 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The Superconducting Super Collider (SSC) is proton-proton collider designed to achieve collisions with 20 TeV per beam, which has been proposed for construction by the U.S. Department of Energy. In the SSC, protons are accelerated and stored in two storage rings that are stacked one on top of the other in an underground tunnel. Collisions can occur at six locations where the proton orbits can be made to intersect. In each collider ring the protons are kept in a roughly elliptical orbit by two types of magnets: dipoles, which bend the proton orbit into a closed loop, and quadrupoles, which deflect the protons back toward the central orbit when they diverge from it. Both types of magnets must use high current density superconducting coils to meet the SSC design requirements. In fact, it is these superconducting coils that make such a supercollider feasible. A dipole field of 6.6 T was chosen as a compromise between the need for the highest practical field and the limits of superconducting technology. The energy of 20 TeV is somewhat more than twenty times the energy of the highest energy storage ring in operation, the Tevatron, a single-ring proton-antiproton collider at Fermi National Accelerator Laboratory (Fermilab) that was the first synchrotron to use superconducting dipoles. To illustrate the technological advances that must be made to make the SSC a reality, the authors compare the parameters of the SSC with the Tevatron. Since the dipoles are the most numerous, the most expensive, and, at least traditionally, the most difficult to develop, an R and D program was started in 1984 to develop a dipole meeting all of the systems requirements for the SSC. Some SSC dipole parameters are discussed.

36911 Measurement of internal forces in superconducting accelerator magnets with strain gauge transducers. Goodzeit, C.L. (0936000); Anerella, M.D.; Ganetis, G.L. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1463-1468 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

An improved method has been developed for the measurement of internal forces in superconducting accelerator magnets, in particular the compressive stresses in coils and the end restraint forces on the coils. The transducers have been designed to provide improved sensitivity to purely mechanical strain by using bending mode deflections for sensing the applied loads. Strain gauge resistance measurements are made with a new system that eliminates sources of errors due to spurious resistance changes in interconnecting wiring and solder joints. The design of the transducers and their measurement system is presented along with a discussion of the method of compensation for thermal and magnetic effects, methods of calibration with typical calibration data, and measured effects in actual magnets of the thermal stress changes from cooldown and the Lorentz forces during magnet excitation.

36912 Tests of full scale SSC R and D dipole magnets. Strait, J. (9500721); Brown, B.C.; Hanft, R.; Kuchnir, M.; Lamm, M.; Lundy, R.; Mantsch, P.; Mazur, P.O.; McInturff, A.; Orr, J.R. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1455-1458 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

Four full-scale SSC R and D dipole magnets, incorporating successive mechanical design improvements, have been quench tested. Three of these magnets are heavily instrumented with sensors to measure the mechanical behavior of the magnets and verify the performance of the mechanical improvements and with multiple voltage taps to locate the origin of quenches. The last two magnets of this series reach the SSC design operating field of 6.6 T in two or fewer quenches. Load cells and motion sensors show that in these two magnets the azimuthal clamping stress is higher at zero current and drops more slowly with excitation than in previous long magnets and that the axial motion of the coil upon excitation has been greatly reduced. Quenches are found to originate preferentially in several locations, suggesting other design improvements.

36913 Magnetic field decay in model SSC dipoles. Gilbert, W.S. (9513034); Althaus, R.F.; Barale, P.J.; Benjegerdes, R.W.; Green, M.A.; Green, M.I.; Scanlan, R.M. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1459-1462 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The authors have observed that some of our model SSC dipoles have long time constant decays of the magnetic field harmonics with amplitudes large enough to result in significant beam loss, if they are not corrected. The magnets were run at constant current at the SSC injection field level of 0.3 tesla for one to three hours and changes in the magnetic field were observed. One explanation for the observed field decay is time dependent superconductor magnetization. Another explanation involves flux creep or flux flow. Data are presented on how the decay changes with previous flux history. Similar magnets with different Nb-Ti filament spacings and matrix materials have different long term field decay. A theoretical model using proximity coupling and flux creep for the observed field decay is discussed.

36914 Impact of high temperature superconductors on the possibility of radio-frequency confinement. Dean, S.O. (9523022). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1554-1557 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

Recent discoveries of superconducting materials that operate at high temperatures may have both technical and economic consequences for magnetic confinement fusion. In addition, they could also open up the possibility of plasma confinement by radio-frequency fields. The new, high temperature superconductors may impact the feasibility of rf confinement in two important ways: (1) higher temperature superconductors should have higher critical B fields and consequently may allow higher critical electric fields to be sustained in the cavity, thus allowing the necessary confining pressure to be achieved; and (2) the higher temperature superconductors lower the refrigeration power necessary to maintain the superconducting cavity, thus allowing a favorable energy balance.

36915 Standard-II and extended tests of the Swiss LCT-coil. Zichy, J.A. (5107200); Jakob, B.; Kwasnitza, K.; Sborchia, C.; Vecsey, G.; Lubell, M.S.; Shen, S.S. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1558-1561 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The Swiss contribution to the international Large Coil Task was a D-shaped 2.5 x 3.5 m . m bore, superconducting toroidal field coil of 8 T. The conductor was made from copper stabilized fully transposed NbTi filaments, cabled in three stages and cooled with pressurized supercritical helium. The testing of the six coils was successfully finished last year at Oak Ridge National Laboratory. Results of the single-coil and the full-array Standard-I tests were reported earlier. This paper presents the data of the ac loss measurements taken during the Standard-II tests. The results are compared with predictions made while designing the coil. Next the results of the Extended Condition tests are discussed. Finally the recently analyzed quench data, taken during the whole test period, are presented.

36916 Thermal-hydraulic simulation of helium expulsion from a cable-in-conduit conductor. Luongo, C.A. (9506433); Loyd, R.J.; Chen, F.K.; Peck, S.D. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1589-1595 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

This paper presents simulation results of a quenching cable-in-conduit conductor (CICC) for application in Superconducting Magnetic Energy Storage (SMES). The details of the model and its computational implementation (the code HEDUMP) are discussed. An extensive verification process shows that HEDUMP can accurately model a quenching CICC. Preliminary results of the simulation are given and discussed. In particular, the normal zone propagation is studied. It is shown that CICCs exhibit a thermohydraulic quench back behavior whereby superconducting regions ahead of the normal front are suddenly driven normal by frictional dissipation and/or compression heating of the fluid.

36917 Effects of insulation on potted superconducting coils. Zeller, A.F. (9519721); DeKamp, J.C.; Magsig, C.T.; Nolen, J.A.; McInturff, A.D. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1536-1537 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

Test coils using identical wire but with either Formvar or Polyesterimid insulation were fabricated to determine the effects of insulation on training behavior. It was found that the type of insulation did not affect the training behavior. While considerable attention has been paid to epoxy formulations used for superconducting coils, little study has been devoted to the effects of the wire insulation on training behavior. If the insulation does not bind well with the epoxy, the wires will not be held securely in place, and training will be required to make the coil operate at its design limit. In fact, the coil may never reach its design current, showing considerable degredation. Conversely, if the epoxy-insulation reaction is to soften or weaken the insulation, then shorts and/or training may result. The authors have undertaken a study of the effects of the insulation on potted coils wet wound with Stycast 2850 FT epoxy. The wire was insulated with one of two insulting varnishes: Formvar (a polyvinyl formal resin) or Polyesterimid (a phenolic resin). Formvar is the standard insulation in the United States while Polyesterimid the European standard.

36918 Advanced superconducting MHD magnet design for a retrofit power plant. Marston, P.G. (9510048); Hale, J.R.; Dawson, A.M. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1562-1564 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

A magnet system has been designed for an MHD topping cycle retrofit of a conventional power plant. The channel power output wil be –35 MWe. The 4.5 T peak on-axis field magnet will be constructed of an unusual NbTi superconductor wound into four subunits per dipole half. These will be three 45^0 saddle coils with circular or ellipsoidal end turns and a single planar coil with a modified racetrack shape that will serve principally as a field shaping coil. This planar coil also enables a substantial reduction in the ratio of peak to central field strength. Among the unique features of this design will be the use of flexible bands in tension as the primary element of the transverse force containment structure. The conductor will be of the cable-in-conduit type with a low copper-to-superconductor ratio cable and a thick-walled aluminum conduit sheath. The sheath will support the axial loads on the saddles and will also provide thermal mass for protection against overheating in the event of an energy dump. The analysis and design of this magnet system and its projected advantages in both performance and economics are discussed.

36919 Manufacture and testing of 465 km superconducting cable for the HERA dipole magnets. Maix, R.K. (Asea Brown Boveri Ltd., Dept. ISM, CH-8050 Zurich (CH)); Salathe, D.; Wipf, S.L.; Garber, M. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1656-1659 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The production of 465 km of keystoned superconducting cable for the HERA dipoles has been completed in July 1988. The specifications for DESY set challenging requirements, such as a minimum critical current of 8000 A at 5.5 T and 4.6 K and the goal to keep the cable's I_c within ± 2%. Experience concerning the strand and cable manufacturing are presented together with some of the mechanical and electrical data. A comparison of the critical currents of the cables with the sum of the critical currents of the 24 individual strands before cabling shows that with the usual definition the cables have practically no degradation. Finally, it is shown how different cable compactions and an additional calibration run through the cabling machine influence the critical current.

36920 Time variations of fields in superconducting magnets and their effects on accelerators. Herrup, D.A. (9500721); Syphers, M.J.; Johnson, D.E.; Johnson, R.P.; Tollestrup, A.V.; Hanft, R.W.; Brown, B.C.; Lamm, M.J.; Kuchnir, M.; McInturff, A.D. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1643-1646 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

A report on the time dependence of magnetic fields in the superconducting magnets of the Fermilab Tevatron has been published. A field variation of order 1 Gauss at the aperture radius is observed. Studies on both full sized Tevatron dipoles and prototype magnets have been used to elucidate these effects. Explanations based on eddy currents in the coil matrix or on flux creep in the superconducting filaments are explored with these tests. Measurement results and techniques for controlling the effect based on new laboratory tests and the latest accelerator operation are presented.

36921 Studies of time dependence of fields in Tevatron superconducting dipole magnets. Hanft, R.W. (9500721); Brown, B.C.; Herrup, D.A.; Lamm, M.J.; McInturff, A.D.; Syphers, M.J. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1647-1651 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The time variation in the magnetic field of a model Tevatron dipole magnet at constant excitation current has been studied. Variations in symmetry allowed harmonic components over long time ranges show a log t behavior indicative of flux creep. Both short time range and long time range behavior depend in a detailed way on the excitation history. Similar effects are seen in the remnant

fields present in full-scale Tevatron dipoles following current ramping. Both magnitudes and time dependences are observed to depend on details of the ramps, such as ramp rate, flattop duration, and number of ramps. In a few magnets variations are also seen in symmetry unallowed harmonics.

36922 Superconducting super collider second generation dipole magnet cryostat design. Niemann, R.C. (9500721); Bossert, R.C.; Carson, J.A.; Engler, N.H.; Gonczy, J.D.; Larson, E.T.; Nicol, T.H.; Ohmori, T. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1615-1619 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The Superconducting Super Collider, a planned colliding beam particle physics research facility, requires ~10,000 superconducting devices for the control of high energy particle beams. The ~7,500 collider ring superconducting dipole magnets require cryostats that are functional, cryogenically efficient, mass producible and cost effective. A second generation cryostat design has been developed utilizing the experiences gained during the construction, installation and operation of several full length first generation dipole magnet models. The nature of the cryostat improvements is presented. Considered are the connections between the magnet cold mass and its supports, cryogenic supports, cold mass axial anchor, thermal shields, insulation, vacuum vessel and interconnections. The details of the improvements are enumerated and the abstracted results of available component and system evaluations are presented.

36923 An alternate method for designing dipole magnet ends. Pope, W.L. (9513034); Green, M.A.; Peters, C.; Caspi, S.; Taylor, C.E. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1611-1614 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

Small bore superconducting dipole magnets, such as those for the SSC, often have problems in the ends. These problems can often be alleviated by spreading out the end windings so that the conductor sees less deformation. This paper presents a new procedure for designing dipole magnet ends which can be applied to magnets with either cylindrical or conical bulged ends to have integrated field multipoles which meet the constraints imposed by the SSC lattice. The method described here permits one to couple existing multiparameter optimization routines (i.e., MINUIT with suitable independent parameter constraints) with a computer code DIPEND, which describes the multiples, so that one can meet any reasonable objective (i.e., minimizing integrated sextupole and decapole). This paper describes how the computer method was used to analyze the bulged conical ends for an SSC dipole.

36924 Optimization of multiwire coil ends having 45 degree bends. Morgan, G.H. (0936000). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1640-1642 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

Multiwire is the name of a proprietary process for affixing small diameter wires to a flat substrate using digitally controlled machinery. It is currently being used to wind trim coils for the SSC dipoles on a flexible substrate which is wrapped around the beam tube. It is proposed for making multipole coils for the Corrector, a regular arc magnet in each half-cell of the Relativistic Heavy Ion Collider (RHIC). The current Multiwire process does not permit a change in direction of the wire other than 45 degree. The present paper answers the question of whether the 45 degree bends in the flattened coil can be located along straight lines in such a way as to eliminate or reduce higher harmonics in the ends. The more general question of bends located along curves is not addressed.

36925 SSC detector solenoid. Fast, R.W. (9500721); Grimson, J.H.; Kephart, R.D.; Krebs, H.J.; Stone, M.E.; Theriot, E.D.; Wands, R.H. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1620-1623 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

A detector utilizing a superconducting solenoid is being discussed for the Superconducting Super Collider (SSC). A useful field volume of 8 m diameter x 16 m length at 1.5-2 T (~1 GJ at 2T) is required. It has been decided that all of the particle physics calorimetry will be inside the bore of the solenoid and that there is no need for the coil and cryostat to be "thin" in radiation lengths. An iron yoke will reduce the excitation required and will provide muon identification and a redundant momentum measurement of the muons. The authors have developed a conceptual design to meet these requirements. The magnet will use a copper-stabilized Nb-Ti conductor sized for a cryostable pool boiling heat flux ~0.025 W/cm^2. A thermosiphon from a storage vessel above the cryostat will be used to prevent bubble stagnation in the liquid helium bath. The operating current, current density, coil subdivision and dump resistor have been chosen to guarantee that the coil will be undamaged should a quench occur. The axial electromagnetic force will be reacted by metallic support links; the stainless steel coil case will support the radial force. The 5000 metric tons of calorimetry will be supported from the iron yoke through a trussed cylindrical shell structure separate from the cryostat. The coil and case, radiation shield and stainless vacuum vessel would be fabricated and cryogenically tested as two 8-m sections. These would be lowered into the underground experimental hall and installed into the iron flux return yoke to provide the required 16-m length.

36926 General formulas for the adiabatic propagation velocity of the normal zone. Devred, A. (9521157). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1698-1705 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The influence on the propagation velocity of the normal zone of four phenomena was investigated: The temperature dependence of the specific heat and the thermal conductivity, the current-sharing zone, the electromagnetic diffusion of current through a possible super-stabilizer, and the thermal diffusion through a possible insulator. At the beginning, these influences were studied independently of each other. In all cases, after creating a model of the particular phenomenon, the equations of thermal and electromagnetic behavior were solved analytically and the expressions for the propagation velocity obtained. These expressions were then put into nondimensional forms, which have allowed us to define four correction factors taking into account the studied influences, depending only on one or two nondimensional parameters. Subsequent studies were made to investigate how to combine these correction factors in order to obtain general formulas for the velocity, taking into account a part or all of these influences. A review is presented here of these formulas, which are of interest for the superconducting windings, where the heat transfer to helium can be neglected on the time scale of the quench process.

36927 Influence of dump voltage and allowable temperature rise on stabilizer requirements in superconducting coils. Schwenterly, S.W. (4832000). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1717-1720 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

A superconducting winding must have enough stabilizer to satisfy two sets of criteria. During normal operation, the amount of stabilizer must be large enough either to make the coil unconditionally stable or give a certain desired stability margin. Once a dump occurs, the amount of stabilizer must be large enough to carry the current without generating excessive dump voltages or allowing the winding to exceed a certain maximum temperature (and maximum pressure, in the case of force-cooled coils). The voltage criterion often dominates for very large coil systems, but it is frequently ignored in initial design studies. This paper gives some simple relations between the dump voltage and the stored energy, temperature rise, and coil geometry that are useful in scoping the required amount of stabilizer. Comparison with some recently proposed fusion magnet system designs indicates that excessive dump voltages could result in some cases. High-temperature superconductors may require more stabilizer than the conventional alloys. Calculations with simple model coil systems indicate how trade-offs between various coil parameters affect the dump voltage.

36928 A comparison of the conductor requirements for energy storage devices made with ideal coil geometries. Hassenzahl, W. (9513034). *IEEE (Institute of Electrical and Electronics*

Engineers) Transactions on Magnetics (USA), 25(2): 1799-1802 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

Superconducting Magnetic Energy Storage (SMES) plants have been proposed in both solenoidal and toroidal geometries. The former is efficient in terms of the quantity of superconductor required per unit of stored energy. For applications where a fringe field could be a problem, the toroidal geometry, which requires at least a factor of two or more material, has been proposed. In addition to the solenoid and toroid, other geometries are possible, such as linear multipoles and spherical coils. These geometries have been considered for use in applications other than energy storage. In this report, the effectiveness (quantity of superconductor/stored energy) is calculated for various coil geometries.

36929 Large coil task instrumentation and diagnostics. Lue, J.W. (4832000); Ellis, J.F.; Fietz, W.A.; Lubell, M.S.; Luton, J.N.; Schwenterly, S.W.; Wilson, C.T.; Wintenberg, R.E. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1734-1737 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The goal of the Large Coil Task (LCT) was to develop large toroidal superconducting magnets for fusion reactors. Each of the six coils built for this task was heavily instrumented with some 200 to 400 sensors and diagnostic voltage taps to test its performance and characteristics. In addition, more than a thousand sensors were installed in the facility and test-stand components to ensure safe and controlled operation. Through the three-year test period, some sensors worked consistently, some failed prematurely, some constantly gave useful information, some were rarely used, and others were vital in a particular test mode. This paper reviews the various type of thermometers, pressure transducers, flowmeters, strain gages, displacement transducers, acoustic emission sensors, field probes, and other diagnostic instrumentation used in LCT. The usefulness of the sensors, the difficulties with some of them, and the reliability of different groups of sensors in this task are described.

36930 Structural characteristics of proposed ITER TF coil conductor. Gibson, C.R. (9500489); Miller, J.R. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1725-1729 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

This paper analyzes the effect of transverse loading on a cable-in-conduit conductor which has been proposed for the toroidal field coils of the International Thermonuclear Experimental Reactor. The primary components of this conductor are a loose cable of superconducting wires, a thin-wall tube for helium containment, and a U-shaped structural channel. A method is given where the geometry of this conductor can be optimized for a given set of operating conditions. It is shown, using finite-element modeling, that the structural channel is effective in supporting loads due to transverse forces and internal pressure. In addition, it is shown that the superconducting cable is effectively shielded from external transverse loads that might otherwise degrade its current carrying capacity.

36931 The effect of transverse stress on the critical current of Nb_3Sn cable-in-conduit superconductors. Summers, L.T. (9513035); Miller, J.R. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1835-1838 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The authors have investigated the effects of transverse stress on the critical current of Nb_3Sn Cable-In-Conduit Conductors (CICC). The sensitivity of the critical current (I_c) to applied stress at 12 T has been determined for CICC's with helium void fractions (f_{He}) in the range of 0.25 - 0.4. I_c has been found to be a function transverse stress with good correlation to single wire data up to stress levels of 50 MPa. At higher stress levels the CICC's show significantly higher degradation with transverse stress. No clear correlation has been found between the stress sensitivity of I_c and f_{He}. The results fall into a broad band suggesting that geometric factors, such as wire position within the cable bundle, exert a strong influence on the I_c vs. stress dependence.

36932 Flux creep in a Tevatron cable. Kuchnir, M. (9500721); Tollestrup, A.V. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1839-1842 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The authors have measured the slow magnetization decay of a short sample (2.3 cm) of Tevatron cable in fields up to 0.3 T. The special susceptometer in development for these measurements is based on a commercial SQUID and is described in detail. The observed decay is logarithmic in time as expected from flux creep in the NbTi filaments. A strong correlation was found between the decay and the magnetization status of the sample. It is too early yet to present a quantitative correlation between what they observed and the decay observed in the sextupole component of Tevatron dipoles. The detailed understanding of this phenomena may be instrumental in guiding the search for efficient superconducting synchrotron operational procedures.

36933 Training in test samples of superconducting cables for accelerator magnets. Ghosh, A.K. (0936000); Garber, M.; Robins, K.E.; Sampson, W.B. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1831-1834 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

In the critical current measurement of some high current NbTi cables, the samples have to be trained by repeated quenching in order to obtain a usable voltage-current curve for I_c determination. This training behavior is most pronounced when the applied field is perpendicular to the wide face of the conductor and is strongly dependent on the copper-to-superconductor ratio and the clamping pressure. Data are given for SSC prototype cables as well as for HERA production conductors. Although a quantitative understanding of the experimental data is still lacking, some speculations regarding stability are presented.

36934 CEBAF superconducting spectrometer design. Brindza, P. (9525040); Alcorn, J.; Carlini, R.; Harwood, L.; LeRose, J.; Mecking, B.; Mougey, J.; O'Meara, J. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1897-1901 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The CEBAF Experimental Nuclear Physics Program is based upon three independent facilities each with unique capabilities. Hall A consists of a pair of High Resolution Spectrometers (HRS), Hall B features a Large Acceptance Spectrometer (LAS) and Hall C will have a high acceptance, high energy electron spectrometer and matching special purpose hadron spectrometer. The performance and operational of these devices can be met effectively through the use of superconducting devices. The Hall A and Hall C spectrometers require high quality, large volume dipole magnets, that although are not beyond the range of conventional magnets, operating considerations favor a superconducting device. The spectrometers require high gradient, large aperture quadrupoles that could not be produced without the use of a superconducting cos 2θ device. The LAS requires a large volume toroidal magnetic field for momentum analysis. The six coils of the Torus must be thin to allow the acceptance to reach 80%. This device could be built using a conventional coil but it would not meet the acceptance specification and the operating cost would be prohibitive. The physics requirements and the rational basis for the design selection will be presented. The analysis that supports the cost effectiveness of the selected design will be presented. The cryogenic system will be covered as well as the integration of the Experimental Hall Cryogenic system and main CEBAF Central Helium Refrigerator.

36935 Considerations against a force compensated coil. Hassenzahl, W. (9513034). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1854-1857 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The cost of structural components in a large superconducting coil may well exceed the coil and cryostat cost. As a result, the idea of constructing a system composed of two different coil types assembled in such a way that the forces balance and reduce the total structural requirement is oft proposed. A suitable geometry has never been found for the fundamental reason that there can be no

force compensated solution. In this paper, the general problem is presented and an analysis of the energy stored and stresses produced in the structure are described in a fundamental way. Finally, the relation between structural mass M and stored energy E that is valid for all magnetic systems is developed.

36936 The effect of self field on the critical current determination of multifilamentary superconductors. Garber, M. (0936000); Ghosh, A.K.; Sampson, W.B. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1940-1944 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

In determining the short sample critical current of conductors of large cross section or high current density the self field produced by the transport current must be taken account in order to obtain a true value for the critical current. A simple model calculation for determining this effect is described. Measurements on wires, cables, and monoliths show the validity and self consistency of the procedures.

36937 A superconducting cos 2θ quadrupole design for the CEBAF high resolution spectrometer. Tuzel, W. (9525040); Alcorn, J.; Brindza, P.; Gavalya, A.; Mougey, J.; Nanda, S. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1914-1917 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The pair of High Resolution Spectrometers (HRS^2) at CEBAF require large aperture, high gradient quadrupoles. A superconducting cos 2θ is under consideration to meet these requirements. The quadrupole has a coil diameter of 1m and a peak gradient of 5 T/m with an effective field length of 1.8 m. The stored energy of this quad is 3.0 MJ. The details of the design of the coil, shrink fit support collar and cryotstat are presented. The analysis of the superconductor, quench behavior and coil protection system is covered.

36938 A conductor, with uncoupled 2.5 μm. diameter filaments, designed for the outer cable of SSC dipole magnets. Gregory, E. (9519456); Kreilick, T.S.; Wong, J.; Collings, E.W.; Marken, K.R.; Scanlan, R.M.; Taylor, C.E. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1926-1929 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

A conductor, with a stabilizer to superconductor ratio of 1.8/1 and containing 22,900, 2.5 μm. diameter, filaments at a wire diameter of 0.65 mm., has been produced. The fabrication procedures used to make this material from a full production size billet, 305 mm. in diameter, are described. Metallographic, electrical and magnetization data are presented and these illustrate that the filaments are completely uncoupled at the size used in the outer SSC cable. This work indicates the feasibility of the commercial manufacture of such a 2.5 μm. diameter filamentry material. Preliminary tests show relatively low J_c's and n values. It is likely that materials with smaller spacings than those used in this work, will be required before the J_c's specified for the SSC can be obtained reproducibly.

36939 A superconducting iron-dominated quadrupole for CEBAF. Harwood, L.H. (9525040); Lassiter, S.; Tuzel, W. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1910-1913 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The present design for the high-resolution spectrometers at CEBAF requires a front quadrupole (QO) that has a gradient x length of 6.8 T with a good field aperture ($1x10^{-8}$ uniformity in gradient) of 16 cm radius. A room temperature design was found too power hungry and interfered with the beam. Engineering and construction of a small cos 2θ magnet was considered to be quite expensive. A Panofsky design was not considered due to the extreme sensitivity of the field quality to errors in conductor placement. A conformal mapping of a window-frame dipole into quadrupole geometry worked well at NSCL. A conceptual design has been developed with the following characteristics; physical length (total)= 1.2 m; iron length= 1.1 m; iron outer dimensions= 54 cm x 80 cm; peak gradient= 6.2 T/m; pole radius= 20 cm; Good field radius= 16 cm; coil peak field= 1.5 T; conductor= 1 mm diameter; Cu/NbTi= 7:1; current= 400 A; turns= 250/quadrant; stored energy= 50 kJ.

36940 Current capacity degradation in superconducting cable strands. Goodrich, L.F. (4435000); Bray, S.L. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1949-1952 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The electromagnetic properties of NbTi strands extracted from Rutherford cables were studied to clarify the effect of mechanical deformation, caused by the cabling process, on the current capacity of the strands. Three different cables were studied, all of which are prototypes for the Superconducting Super Collider's dipole magnets. The extracted cable strands were instrumented to allow measurement of the voltage across several key regions of mechanical deformation as a function of current and the orientation of the applied magnetic field. The resulting data are presented in terms of the strand's voltage profile as well as its critical current in order to more thoroughly characterize the conductor's electromagnetic properties. The cable strands show very localized reductions in current capacity that are well correlated with the regions of high mechanical deformation. For example, at a particular field orientation, the voltage across a portion of the strand that is only 3% of the total strand length contributes 92% of the total strand voltage. Two applied magnetic field orientations, parallel and perpendicular to the cable's width, have pronounced effects on the electrical properties of the strand. Both of these magnetic field orientations will arise in applications.

36941 Intermediate scale industrially processed Nb_3Sn(Ti) by powder metallurgy. Pourrahimi, S. (9502899); Tnieme, C.L.H.; Foner, S. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1964-1967 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The authors' powder metallurgy processing of Nb_3Sn(Ti) wire was scaled up to 75 mm diameter billets each containing 4 kg of pressed powder composite. Prealloyed Nb-1.5wt%Ti powder was used for optimum high field properties. An initial hot extrusion step provided complete consolidation and excellent integrity of the powder composite. Using the extruded bars, various single and multiple tin core billets were prepared and hydrostatically extruded to 12 mm diameter bars. Long lengths of internal tin core wire were drawn without any breakage to less than 1 mm diameter. In order to evaluate the performance of long length wires, small magnets were fabricated from these wires and tested in background fields of water-cooled Bitter magnets up to 20 tesla. $J_c=10^4 A/cm^2$ was measured at 20T (equal to the short sample performance) and n-values at high fields were comparable to, or better than those of conventional Nb_3Sn(Ti) wires. The processing, performance and microstructure is discussed. This intermediate scale process used conventional metal forming techniques that can be scaled to larger P/M industrial processing.

36942 A superconducting toroidal magnet for the CEBAF large acceptance spectrometer. O'Meara, J. (9525040); Alcorn, J.; Brindza, P.; Chew, M.S.; Doolittle, G.; Fowler, M.; Mecking, B.; Riggs, C.; Tilles, D.; Tuzel, W. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1902-1905 (Mar 1989). (CONF-880812--: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The CEBAF Physics Program requires a Large Acceptance Spectrometer covering nearly all of the 4π solid angle for studying complex electronuclear interactions. This device relies on a six coil toroidal magnetic field to provide momentum analysis. The desire to maximize solid angle coverage led to a thin superconducting toroid design. The main device has the following parameters: an outside diameter of 4.6 m, an active length of 5 m, a peak field in the toroidal volume of 1.2 T, and a stored energy of 18 MJ. An intrinsically stable design was selected to minimize the overall space requirements of the toroid. The individual coils of the toroid are approximately kidney shaped, the negative curvature provides a field free region for targets coming from the requirement to have good particle focusing properties. The overall design is presented along with stress analysis, conductor and quench analysis and cryogenic cool down analysis. The six coils are powered in series and are protected by an external resistor. The analysis and operational characteristics of the protection system are presented.

36943 A superconducting dipole concept for the CEBAF high resolution spectrometers. Alcorn, J. (9525040); Brindza, P.; Fowler, M.; Harwood, L.; Hunter, T.; Tuzel, W. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 1906-1909 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

CEBAF's Hall A requires a pair of High Resolution Spectrometers (HRS) for performance of electron/hadron coincidence experiments at up to 4 GeV/c. Momentum analysis for each arm is provided by a 45^0 vertical bending dipole having a useful field volume 6.0 m long x 30-40 cm wide (pole gap) x 80 cm high. A resistive 30 cm gap dipole has been selected for the reference 4 GeV/c HRS, utilizing a qQQDQQ magnet configuration. However, recent studies aimed at equipment cost reduction indicate that a 40 cm gap superconducting dipole based upon less stringent field uniformity requirements may be attractive, either with the reference HRS or with a revised design, employing fewer magnet elements. The concept described herein is an H frame superconducting magnet, with contoured poles and resistive interpole field shaping coils, to achieve a field quality of 1 gauss/cm across the aperture at all useful excitation levels. This approach yields minimal pole width and requires only conventional fabrication tolerances.

36944 Reaction kinetics of phase formation in Nb-Al powder metallurgy processed wire. Coffey, K.R. (9510048); Barmak, K.; Rudman, D.A.; Thieme, C.L.H.; Foner, S. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 2093-2096 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The sequence of phases formed in the low temperature reaction of niobium and aluminum to form the A15 superconductor, Nb_3Al, was studied in high areal reduction powder metallurgy processed wire samples. The reaction path observed was the same as that reported previously for multilayer Nb/Al thin films. The reaction proceeds without the formation of the sigma phase, Nb_2Al, resulting in a metastable A15 of higher Al concentration. The extent of this metastable extension is estimated to be 22-24 atomic percent Al based upon the resistive T_c of 17.0 K observed. The reaction kinetics of the wire samples were examined by scanning heat flux calorimetry, and the activation energy of A15 formation was found to be 3.1 eV. The formation of $NbAl_3$ and dissolution of Al into the Nb lattice were both observed as precursor reactions with much lower activation energies.

36945 Low contact-resistivity junctions to ceramic superconductors. Maley, M.P. (9512470); Willis, J.O.; Katz, J.D.; Castro, R.G.; Aikin, R.M. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 2053-2055 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The authors report on the development of a plasma-arc spray process for the application of low resistivity silver contact junctions onto $YBa_2Cu_3O_7$ sintered ceramic materials. The contact resistances decrease montonically with decreasing temperature and are typically $\sim 10^{-8}\Omega\text{-cm}^2$ at 75 K. I-V characteristics are linear up to a critical current density that agrees with that of the underlying superconducting material. Advantages over other contact methods include: ease of application, absence of any post-processing treatment, and applicability to large areas and arbitrary shapes.

36946 Normal state resistance and low temperature magnetoresistance of superconducting cables for accelerator magnets. Sampson, W.B. (0936000); Garber, M.; Ghosh, A.K. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 2097-2100 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The normal state resistivity of the superconducting NbTi cable used in accelerator magnets is usually specified by the resistance per unit length at room temperature (295 K) and the residual resistance ratio (RRR). Using these resistance parameters, the amount of copper in the multifilamentary wire can be calculated. This method is consistent with the traditional etch and weigh technique, and as such is a alternative and convenient way of specifying the copper to superconductor ratio. In principle the magnetoresistance can be calculated from the RRR and the Kohler Plot, for copper. In practice however, measurements of magnetoresistance for a wide variety of SSC inner cable show considerable disagreement with calculation. In this paper the magnetoresistance data on cables with RRR ranging from 50 to 175 are analyzed taking into account the conductor geometry and the effect of the small interfilamentary spacing on the resistivity of copper.

36947 Grain size control in powder processed $Y_1Ba_2Cu_3O_x$. No, K. (9517861); Verhoeven, J.D.; McCallum, R.W.; Gibson, E.D. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 2184-2187 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

It is demonstrated that small grained $YBa_2Cu_3O_x$ (123) material can be made from powders of Y_2O_3, $BaCO_3$ and CuO by avoiding liquid phase formation in the high temperature treatments. Techniques for avoiding liquid phase formation are demonstrated and transport J_c measurements versus grain size are presented.

36948 Ductility enhancement in unreacted internal-Sn Nb_3Sn through low-temperature anneals. Strum, M.J. (9513035); Summers, L.T.; Miller, J.R. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 2208-2211 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

A lack of tensile ductility in as-drawn superconducting wires at room temperature can lead to damage during magnet fabrication steps such as cabling and coil winding. The tensile elongation of 0.42 mm internal-Sn Nb_3Sn conductor in the as-drawn unreacted condition is limited to less than 3 percent at room temperature. The tensile elongation is substantially enhanced through low-temperature annealing treatments at 200^0C, increasing to as high as 10% after 24 hrs. at 200^0C. This effect is attributed to increased work hardening capacity from softening which reduces yield strengths up to 50% while maintaining 90% of the tensile strength. Fracture surfaces of annealed wires reveal increased adhesion between the Sn cores and the surrounding Cu as well as an increase in ductile void coalescence as the failure mechanism within the Cu. Preliminary results on the pre-reaction strain sensitivity of reacted wire critical currents confirm the increased strain tolerance in annealed wires.

36949 Superconductivity, critical current density, and magnetic properties of Fe-substituted $Y_1Ba_2(Cu_{1-x}Fe_x)_3O_z$ materials. Sekula, S.T. (4832000); Brynestad, J.; Christen, D.K.; Thompson, J.R.; Kim, Y.C. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 2266-2269 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The superconductive properties of a series of Fe-substituted $Y_1Ba_2(Cu_{1-x}Fe_x)_3O_z$ materials, with x = 0 to 10 at. % Fe, have been studied. It was found that the T_c decreased linearly with Fe content x at the rate of 6.7 K/at. %. The intragranular critical current density J_c decreased exponentially both with (1) reduced temperature T/T_c and (2) Fe concentration. Since the addition of Fe strongly drives the structure toward tetragonality, it is concluded that neither copper-oxygen chains nor macroscopic twinning are essential for high temperature superconductivity.

36950 Superconducting properties of magnetron sputtered high T_c thin films containing oxide compounds of yttrium, bismuth, or thallium. Kang, J.H. (0448000); Kampwirth, R.T., Gray, K.E. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 2226-2229 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The authors have used multiple source magnetron sputtering to prepare thin films of Y-Ba-Cu-O, Bi-Ca-Sr-Cu-O, and Tl-Ca-Ba-Cu-O on (100) $SrTiO_3$, (100) MgO, and ZrO_2-9%Y_2O_3 substrates. Y-Ba-Cu-O films grow best on $SrTiO_3$ with mostly an a-axis orientation. Stoichiometry, particularly the Ba/Ca ratio must be within 2% of the correct value to obtain narrow ΔT_c transitions. Conversely the 80K phase of Bi-Ca-Sr-Cu-O films grows best on MgO substrates and has a predominant c-axis orientation. The requirements on composition are less stringent, however, the annealing temperature must be held within a narrow around 865^0C to obtain the best films.

The best films of Tl-Ca-Ba-Cu-O compounds are grown on (100) oriented and polycrystalline ZrO_2 substrates. The highest transition temperature, T_{c0}, where the resistance goes zero is about 114K in the $Tl_2Ba_2Ca_2Cu_3O_x$ phase and 100-105K in $Tl_2Ba_2Ca_1Cu_2O_x$ and $Tl_1Ba_2Ca_2Cu_3O_x$ phase samples. The upper critical field measurements show high anisotropies in the critical field slopes ($\geq$70 for Tl-Ba-Ca-Cu-O compounds and $\approx$15 for Bi-Sr-Ca-Cu-O compounds), as might be expected from highly oriented materials. The authors compare the preparation conditions and superconducting properties, including T_c, ΔT_c, dB_{c2}/dT (parallel and perpendicular to film surface), of all three compounds.

36951 The critical density throughout the superconducting phase of multifilamentary Nb_3Sn wire for forced flow fusion applications measured using the Bean-Campbell AC magnetization technique. Hampshire, D.P. (9524637); Larbalestier, D.C. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 2382-2385 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

Ac magnetization measurements for transverse orientation have been completed on a multifilamentary Nb_3Sn composite wire which is a candidate for fusion applications. Using these data, the critical current density (J_c) has been determined using the Bean-Campbell analysis in the ranges $B < 10$ tesla and $4.2\ K < T < 11\ K$. Technical operating parameters required during forced flow conditions are explicitly determined.

36952 Anisotropies in the magnetic penetration depth and critical current density of $R_1Ba_2Cu_3O_{7-x}$ (R = Y or Ho), measured on magnetically-aligned powder composites. Christen, D.K. (4832000); Sekula, S.T.; Thompson, J.R.; Brynestad, J.; Sales, B.C.; Boatner, L.A.; Budai, J.D.; Kim, Y.C. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 2325-2327 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

Dispersed, uniaxially-aligned powder composites of $R_1Ba_2Cu_3O_{7-x}$ (R = Y or Ho) were formed by suspending the powder in a liquid organic matrix that was then solidified ina magnetic field. From the observed particle dimensions and magnetic susceptibility measurements for fields applied either parallel or perpendicular to the Cu-O planes, the authors have inferred anisotropies in the superconducting magnetic penetration depth λ. From the magnetization hysteresis in the mixed state, they have derived relative anisotropies in the critical current densities J_c. The observed anisotropies are qualitatively similar for both rare-earth-based materials, but show some quantitative distinctions.

36953 Bi-Ca-Sr-Cu-O superconductors. Green, S.M. (9525167); Rudee, M.L.; Mei, Y.; Luo, H.L.; Ramesh, R.; Thomas, G. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 2360-2363 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The connectivity problem in Bi-Ca-Sr-Cu-O superconductors is addressed in this paper. Bulk samples always exhibit a step in the resistivity plot, consequent to which zero resistance is obtained around 75K, although the onset is above 110K. Magnetic measurements indicate the presence of almost equal fractions of two superconducting phases with transition temperatures of 110K and about 80K. The microstructure of these samples has been examined using several transmission electron microscopy techniques. The superconducting phases exhibit a polytypoid type structure with the general formula of $Bi_2Sr_2\ Ca_{n-1}Cu_nO_y$, where n takes on values of 1,2,3 and in some infrequent cases 4. The c-parameter of T_c increase with n. In almost all the superconducting grains, the lower T_c(n=1 or 2) polytypoid is observed at the grain boundaries. Thus, the 110K polytypoid in each grain is not connected to similar regions in other grains. The lower T_c polytypoid is observed at the grain boundaries due to a reduction of Ca and/or Cu. It is suggested that the controlled addition of PbO enables the formation of a Pb-rich liquid phase which makes the composition near the grain boundaries uniform. Consequently, the step in the resistivity plot disappears.

36954 Rf properties of high-T_c superconductors. Bohn, C.L. (0448000); Delayen, J.R.; DosSantos, D.I.; Lanagan, M.T.; Shepard, K.W. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 2406-2409 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

The authors have investigated the rf properties of high-T_c superconductors over a wide range of temperature, frequency, and rf field amplitude. They have tested both bulk polycrystalline samples and thick films on silver substrates. At 150 MHz and 4.2 K, the authors have measured a surface resistance of 18 $\mu\Omega$ at low rf field and 3.6 mΩ at an rf field of 270 gauss. All samples showed a strong dependence of the surface resistance on rf field; however, no breakdown of the superconducting state has been observed up to the highest field achieved (320 gauss).

36955 In situ growth of superconducting YBaCuO using reactive electron-beam coevaporation. Missert, N. (9506815); Hammond, R.; Mooij, J.E.; Matijasevic, V.; Rosenthal, P.; Geballe, T.H.; Laderman, S.S.; Lu, C.; Garwin; Barton, R. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 2418-2421 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

Conditions required for in situ growth of YBaCuO thin films by reactive electron-beam evaporation have been explored. Three sources of activated oxygen (atomic oxygen from microwave discharge, a plasma generated by electron beams and an ion beam) were compared. The best results so far were obtained with atomic oxygen. Epitaxial films with high critical currents were grown on $SrTiO_3$ <100> and <110>, Al_2O_3 <1102> and MgO <100> at 600^0C. Evaporation rates were controlled with a rate monitor using atomic absorption.

36956 A simple method for preparing superconducting high Tc thin films. Romano, P. (9900969); Nigro, A.; Vaglio, R.; Signorelli, E.; Gray, K.E. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics (USA),* 25(2): 2481-2483 (Mar 1989). (CONF-880812–: Applied superconductivity conference, San Francisco, CA, USA, 21-25 Aug 1988).

High quality superconducting thin films of the high Tc compound $YBa_2Cu_3O_7$ have been prepared on sapphire using a new, simple method that combines d.c. magnetron sputtering from a single target and evaporation from a heated source. The method should be especially suitable for depositing thin films on complex surfaces. $YBa_2Cu_3O_{7-\delta}$ films with Tc = 92K (onset) were prepared using an YCu_3 target and evaporating barium by a specially designed, feedback controlled, molybdenum heater using both pure barium or a barium-aluminum alloy. The films were characterized by X-rays, Electron Dispersion Spectroscopy and other techniques.

4203 Lasers

Refer also to citation(s) 35831, 35928, 36682, 36683, 37400, 37463, 37473, 37486, 37582

36957 (AD-A–201358/9/XAB) **Optical pumping of vibrational overtones in KI:CN-infrared lasers.** Gosnell, T.R.; Sievers, A.J.; Pollock, C.R. Cornell Univ., Ithaca, NY (USA). Lab. of Atomic and Solid State Physics. Aug 1988. 4p. Available from NTIS, PC A02/MF A01.

Pub. in Optics Letters, Vol. 13, 631-633(Aug 1988).

By using open-resonator configurations, continuous-wave laser oscillation at 4.9 micro m was obtained on the 2=1 vibrational transition of CN– impurities embedded in KI. Population inversion in this device is produced by direct optical pumping of the first-overtone transition of CN– at 2.42 micro m with a tunable (F_2^+) A color-center laser. By using a closed resonator, simultaneous pulsed-laser output was observed from the 3=2 and 2=1 transitions of CN- following long-pulse pumping of the second-overtone transition with the recently developed high-power NaC1:F2+:O2- color-center laser.

36958 (AD-A–204800/7/XAB) **Laser action from syn-(methyl,methyl) bimane.** Pavlopoulos, T.G.; Boyer, J.H.; Politzer, I.R.; Lau, C.M. Naval Ocean Systems Center, San Diego, CA (USA). 1 Dec 1986. 4p. Available from NTIS, PC A02/MF A01.

Pub. in Jnl. of Applied Physics, Vol. 60, No. 11, 4028-4030(1 Dec 1986).

At the present, the Coumarin laser dyes are the ones most widely used for the spectral region stretching from 440 to 550 nm. However, the Coumarin dyes have rather poor photochemical stability. While searching for more stable and efficient laser dyes, the authors 3,4,6,7-tetramethyl-1, 5-diazabicyclo(3.3.0)octa-3, 6-diene-2, 8-dion (SYN-(CH_3,Ch_3)B for short). This new heterocyclic molecule was first reported by Kosower, Pazhenchevsky, and Hershkowitz in 1978. Their work included the observation of strong and striking fluorescence properties, as well as good photochemical stability, for these compounds. It should be emphasized that strong fluorescence (high quantum fluorescence yield) of organic compounds which are not benzene derivatives is rare. The quantum fluorescence yield of the syn-(R2,R1)B ranges from 0.7 to 0.9. The isomer anti-(R2,R1)B is only weakly fluorescent. There are two specific spectroscopic parameters of laser dyes that critically determine the laser action efficiency of flashlamp and cw laser-pumped dye lasers: (a) a high quantum fluorescence yield and (b) low triplet-triplet (T-T) absorption over the fluorescence (laser action) spectral region of the laser dye. The author, therefore, recorded the T-T absorption spectrum of syn-(CH_3,CH_3)B. We compared the laser action parameters of syn-(CH_3,CH_3)B with those of Coumarin 30. Both syn-(CH_3,CH_3)B and Coumarin 30 showed laser action in the same spectral region. syn-(CH_3,Ch_3)B lased only 30% less efficient than did Coumarin 30. Reprints. (mjm)

36959 (AD-A–205080/5/XAB) **Laser action in chromium-activated forsterite for near-infrared excitation.** Petricevic, V.; Gayen, S.K.; Alfano, R.R. City Univ. of New York, NY (USA). 15 Oct 1988. 3p. Available from NTIS, PC A02/MF A01.

Pub. in Applied Optics, Vol. 27, No. 20, 4162-4163 (15 Oct 1988).

Recently, the authors reported room-temperature pulsed-laser action in chromium-activated forsterite (Cr:Mg_2SiO_4). The free-running laser output was centered at 1235 nm with a spectral bandwidth (full width at half-maximum,FWHM) of 22 nm. The laser emission was stimulated by the 532-nm excitation of the green-red absorption band of the system. The crystal is characterized by a shallow absorption band spanning the 850-1200-nm wavelength range, which overlaps a significant portion of the emission spectrum and was previously thought to inhibit laser action in that region. In this communication, laser action in chromium-doped forsterite for 1064-nm excitation of this band is reported. The near infrared absorption thus turns out to be effective in populating the initial level of the lasing transition.

36960 (AD-A–205233/0/XAB) **Single-frequency microchip Nd lasers.** Zayhowski, J.D.; Mooradian, A. Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab. 1 Jan 1989. 4p. (JA–6171). Available from NTIS, PC A02/MF A01.

Pub. in Optics Letters, Vol. 14, 24-26(1 Jan 1989).

Optically pumped, single-frequency, Nd-doped, solid-state lasers were constructed using flat-flat cavities, which were diced from large dielectrically coated wafers of various crystals. For example, a Nd:YAG laser with a cavity length of 730 um operated at room temperature in a single longitudinal mode from a threshold of less than 1 mW to greater than 40 times the threshold. The slope efficiency was greater than 30%. Heterodyne measurements showed an instrument-limited linewidth of 5 kHz. The microchip lasers demonstrate ways to reduce greatly the cost and complexity of fabricating small lasers and electro-optic devices.

36961 (CONF-8808146–17) **Free electron laser with small period wiggler and sheet electron beam: A study of the feasibility of operation at 300 GHz with 1 MW CW output power.** Booske, J.H.; Granatstein, V.L.; Antonsen, T.M. Jr.; Destler, W.W.; Finn, J.; Latham, P.E.; Levush, B.; Mayergoyz, I.D.; Radack, D.; Rodgers, J. Maryland Univ., College Park, MD (USA). Lab. for Plasma Research. 1988. 16p. Sponsored by DOE Energy Research. DOE Contract FG05-87ER52147. From 10. international free-electron laser conference; Jerusalem, Israel; 29 Aug - 2 sep 1988. Order Number DE89014759/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The use of a small period wiggler (ℓ_w < 1 cm) together with a sheet electron beam has been proposed as a low cost source of power for electron cyclotron resonance heating (ECRH) in magnetic fusion plasmas. Other potential applications include space-based radar systems. We have experimentally demonstrated stable propagation of a sheet beam (18 A. 1 mm x 20 mm) through a ten-period wiggler electromagnet with peak field of 1.2 kG. Calculation of microwave wall heating and pressurized water cooling have also been carried out, and indicate the feasibility of operating a near-millimeter, sheet beam FEL with an output power of 1 MW CW (corresponding to power density into the walls of 2 kW/cm^2). Based on these encouraging results, a proof-of-principle experiment is being assembled, and is aimed at demonstrating FEL operating at 120 GHz with 300 kW output power in 1 μs pulses: electron energy would be 410 keV. Preliminary design of a 300 GHz 1 MW FEL with an untapered wiggler is also presented. 10 refs., 5 figs., 3 tabs.

36962 (CONF-8904239–Summ.) **Proceedings of the small period wiggler designs workshop: Summary.** Los Alamos National Lab., NM (USA). 1989. 11p. Sponsored by DOE Energy Research. DOE Contract FG05-87ER52147. From Small-Period Wiggler Designs workshop; Los Alamos, NM, USA; 13 Apr 1989. Order Number DE89014758/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the following: comments on wiggler designs; electromagnetic and electromagnet wigglers; microfabrication-compatible wiggler designs; superconducting wigglers with rare earth inserts; wiggler scaling in high power systems; current sheet wigglers; micro-permanent magnet wigglers; and pulsed wire wigglers

36963 (LA-UR–89-1932) **An improved hibachi support structure for electron-beam diode foils.** Kang, M.; Weinstein, B.; Rose, E.A. Los Alamos National Lab., NM (USA). 1989. 15p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890665–30: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89014023/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

AURORA is a KrF laser system at Los Alamos designed to demonstrate the feasibility of optical multiplexing for KrF lasers. The first two amplifiers in the amplifier chain are the Small Aperture Module (SAM) and the Pre-Amplifier (PA). This paper will describe the engineering design of replacement hibachis for the SAM and PA as part of a general upgrade to increase e-beam pumping. Hibachi shading loss mechanisms are briefly discussed. A simple model that calculates relative shading losses between hibachis for the axial-field-free case is presented. Based on modeling results, sample hibachi slots were fabricated and foils tested to destruction to verify standard membrane stress equation. Test results were used in the design and fabrication of hibachis that were installed on the amplifiers. Relative energy deposition measurements using capacitive manometers are presented. 10 refs., 3 tabs.

36964 (LBL–27034) **Prospects for the FEL [Free Electron Laser].** Sessler, A.M. Lawrence Berkeley Lab., CA (USA). Apr 1989. 18p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8904228–1: CERN accelerator school, Chester, UK, 6-13 Apr 1989). Order Number DE89012998/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The future for FELs depends upon the very large number of applications which is envisioned for them. These grow out of the FEL extensive range of wavelengths, tunability, and high power capability. High power requires demonstration of optical guiding. Tunability has already been demonstrated. And the effort to extend the range of wavelengths is ever ongoing. The future will also bring more work on gas-loaded FELs, on electromagnetic wigglers, and on harmonic generation. We can, also, look forward to observation of various new effects, a few of which will be described. Finally, a list of various FEL projects around the world will be given. 12 refs., 5 figs., 8 tabs.

36965 (LBL–27035) **High-power, high-efficiency FELs.** Sessler, A.M. Lawrence Berkeley Lab., CA (USA). Apr 1989. 15p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8904228–2: CERN accelerator school, Chester, UK, 6-13 Apr 1989). Order Number DE89013002/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

High power, high efficiency FELs require tapering, as the particles loose energy, so as to maintain resonance between the electromagnetic wave and the particles. They also require focusing of the particles (usually done with curved pole faces) and focusing of the electromagnetic wave (i.e. optical guiding). In addition, one must avoid transverse beam instabilities (primarily resistive wall) and longitudinal instabilities (i.e sidebands). 18 refs., 7 figs., 3 tabs.

36966 (UCRL–98850) **Tapering FEL amplifiers in wiggler period and field.** Shay, H.D.; Deis, G.A.; Scharlemann, E.T.; Smith, T.E. Jr. Lawrence Livermore National Lab., CA (USA). 13 Mar 1989. 24p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-48. (CONF-8808146–16: 10. international free-electron laser conference, Jerusalem, Israel, 29 Aug - 2 sep 1988). Order Number DE89014050/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Tapering a free-electron laser (FEL) amplifier to improve extraction after gain saturation can be accomplished by varying both the wiggler period and the wiggler field. This paper considers specific FEL designs and demonstrates the improvement in extraction that can be achieved by utilizing both variations. Fabrication considerations make a continuously varying wiggler period impractical for long wigglers, and so this technique entails discontinuous steps in the wiggler period. Such steps in wiggler period must be introduced in a manner such that they do not introduce steering in the electron beam for reasonable ranges of transverse velocities and energies nor induce a large spread in phase shifts. We discuss such techniques. 8 refs., 7 figs., 1 tab.

36967 **Nonlinear optical beam manipulation, beam combining, and atmospheric propagation.** SPIE - Volume 874. Fischer, R.A. 334p. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-8801121–: Nonlinear optical beam manipulation, beam combining, and atmospheric propagation, Los Angeles, California, USA, 11-14 Jan 1988).

These proceedings collect papers on optics: Topics include: diffraction properties of laser speckle, coherent beam combination by plasma modes, nonlinear responses, deformable mirrors, imaging radiometers, electron beam propagation in inhomogeneous media, and stability of laser beams in a structured environment.

36968 **Spectroscopy of absorbers in rare gas-halide laser plasmas.** Eden, J.G. (Univ. of Illinois, Urbana, IL (US)); Schloss, J.H.; Kane, D.J.; Shannon, D.C.; Abele, C.C.; McCown, A.W. v.v of Gas laser technology. Sauerbrey, R.A.; Tillotson, J.H.; Chenausky, P.P. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-8801118–: Gas laser technology, Los Angeles, California, USA, 11-12 Jan 1988).

The spectroscopy and chemical kinetics of small molecules known (or believed) to absorb in rare gas-halide laser plasmas are being studied by laser excitation and probing techniques. Two examples from recent experiments - inter-Rydberg absorption spectroscopy of Ar_2 and photoassociation of Kr-F collision pairs - are described.

36969 **Sideband generation in saturated pulsed dye amplifiers with multiple cw single mode injection.** Comaskey, B. (Lawrence Livermore National Lab., Laser Isotope Separation Program, P.O. Box 5508, Livermore, CA (US)); Daly, T.; Haynam, C.; Morris, J.; Paisner, J.; Young, R. v.v of Pulsed single-frequency lasers. Bischel, W.K.; Rahn, L.A. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-880199–: Pulsed single frequency lasers: technology and applications, Los Angeles, California, USA, 12-13 Jan 1988).

The output spectral characteristics of fully saturated pulsed dye amplifiers for multimode input waves having amplitude modulation (AM) are modeled and compared with experimental measurement. The AM input in our experiments was generated by combining the outputs of two single-mode dye lasers. The spectral output of the saturated dye amplifiers consisted of the input frequencies and several sidebands spaced by the input difference or beat frequency. For our experimental system with kiton red dye amplifiers, up to 20% of the output intensity was contained in these sidebands. Sideband production was observed to decrease as the beat frequency increased with a characteristic half-width of approximately 10 GHz.

36970 **Calibration of beam power monitors for laser welding.** Thacher, P.D. (Sandia National Labs., Organization 7241, P.O. Box 5800, Albuquerque, NM (US)). v.v of Laser beam radiometry. Sanders, A.A. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-8801131–: Laser beam radiometry, Los Angeles, CA, USA, 14-15 Jan 1988).

A detailed microfacies and seismic interpretation was conducted for the Caddo lime formation, a relatively unstudied Middle Pennsylvanian hydrocarbon reservoir in northcentral Texas. Five cores from Chalky Mountain field in Taylor County were studied and found to contain eight distinct but gradational facies: clay shale, stylonodular bedded wackestone, clay-rich packstone, crinoid-bryozoan packstone, algal wackestone to boundstones, skeletal-algal grainstone, oolitic-skeletal grainstone, and coral-skeletal packstone. The limestone facies form three cyclic packages, each of which contains a transgressive facies followed by a shoaling upward regressive sequence of facies. The cycles are bounded by the transgressive, clay-rich limestone facies identified in the gamma-ray logs as positive radioactive kicks that can be correlated between wells. Well logs, synthetic seismograms, and high-resolution seismic reflection profiles were used to map the subsurface structure of the Caddo Lime in the Chalky Mountain field area.

36971 **Nd:Cr:GSGG, will it replace Nd:YAG.** Stokowski, S.E. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 5508, L-490, Livermore, CA (US)). v.v of New slab and solid-state laser technologies and applications. Guch, S.; Eggleston, J. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1987). (CONF-870132–: OE/LASE '87, Los Angeles, CA, USA, 11-16 Jan 1987).

Gadolinium scandium gallium garnet (GSGG) codoped with neodymium (Nd) and chromium (Cr) is a new laser material that can make more efficient lasers. The author compares it to Nd-doped yttrium aluminum garnet (YAG) for two types of systems: large zig-zag slab lasers and small rod lasers. Nd:Cr:GSGG has a significant advantage over Nd:YAG in large systems because of its high efficiency and availability in large sizes. In small rod systems, though, the larger thermal lensing and birefringence in Nd:Cr:GSGG make it less desirable than Nd:YAG from an optical standpoint, but its high efficiency means that laser system size and weight can be reduced. The author reviews progress in obtaining large Nd:Cr:GSGG slabs. In this effort, Allied-Signal Corp. has successfully grown 5-inch diameter Nd:Cr:GSGG boules.

36972 **Pulse-train amplification of subnanosecond near-transform-limited KrF laser pulses.** Raymond, T.D. (Sandia National Labs., Albuquerque, NM (US)); Reiser, C.; Adams, R.G.; Michie, R.B.; Woods, C. v.v of Pulsed single-frequency lasers. Bischel, W.K.; Rahn, L.A. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-880199–: Pulsed single frequency lasers: technology and applications, Los Angeles, California, USA, 12-13 Jan 1988).

The authors show that extraction of energy in the form of a train of subnanosecond pulses from a discharge-pumped KrF excimer amplifier is an efficient means of enhancing the intensity of the laser radiation. The effect of interpulse time separation and pulse width are investigated experimentally. Intensity enhancements of up to 7x above steady-state, with extraction efficiencies in excess of 60% of the steady-state value, were obtained by amplifying a train of 0.4-nsec full-width-at-half-maximum (FWHM) pulses separated by 5 nsec.

36973 **Coherent VUV laser at 130nm.** Muller, C.H. III (Spectra Technology, Inc., 2755 Northup Way, Bellevue, WA (US)); Lowenthal, D.D.; DeFaccio, M.A.; Cimolino, M.; Hauck, J.P. v.v of Pulsed single-frequency lasers. Bischel, W.K.; Rahn, L.A. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-880199–: Pulsed single frequency lasers: technology and applications, Los Angeles, California, USA, 12-13 Jan 1988).

Vacuum ultraviolet laser output energies of 0.25 mJ 92MW cm^{-2} (unfocused) at 130 nm have been achieved using four-wave sum-frequency mixing in mercury. High energy conversion efficiencies of 2.7 percent have been demonstrated in a collimated beam geometry over 1 meter interaction lengths. The 130 nm radiation is tunable over 2.5 cm^{-1} and the pulse length is 2.2 ns. The experimental

facility assembled to produce this efficient VUV laser will be described, and comparison between experimental measurements and theory are provided.

36974 Coherent VUV source at 130 nm. Smith, A.V. (Sandia National Labs., Albuquerque, NM (US)); Hadley, G.R.; Alford, W.J. v.v of Pulsed single-frequency lasers. Bischel, W.K.; Rahn, L.A. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-880199–: Pulsed single frequency lasers: technology and applications, Los Angeles, California, USA, 12-13 Jan 1988).

The authors goal is to maximize conversion efficiency of sum-frequency mixing in an energy scalable system. They analyze 130.2-nm generation via two-photon-resonant four-wave mixing in Hg vapor for unfocused light beams emphasizing an understanding of efficiency-limiting processes. Their calculations, based on their measurements of Hg dipole matrix elements, indicate that mixing efficiencies of 5 - 10% should be possible.

36975 Stability of laser beams in a structured environment. Keskinen, M.J. (Geophysical and Plasma Dynamics Branch, Plasma Physics Div., Naval Research Lab., Washington, DC (US)); Lee, Y.C. v.v of Nonlinear optical beam manipulation, beam combining, and atmospheric propagation. Fischer, R.A. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-8801121–: Nonlinear optical beam manipulation, beam combining, and atmospheric propagation, Los Angeles, California, USA, 11-14 Jan 1988).

Parametric instabilities of laser radiation in a structured space plasma environment have been surveyed. The authors compute approximate thresholds and growth rates for stimulated Raman scattering, stimulated Brillouin scattering, stimulated Compton scattering, and modulation/filamentation processes.

4204 Heat Transfer and Fluid Flow

Refer also to citation(s) 35688, 36422, 36877, 36926, 37022

36976 (CONF-881123–4) **Pressure drop and heat transfer characteristics of nearly neutrally buoyant particulate slurry for advanced energy transmission fluids.** Liu, K.V.; Choi, U.S.; Kasza, K.E. Argonne National Lab., IL (USA). 1988. 25p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From 3. international symposium on liquid-solid flows (WAM); Chicago, IL, USA; 28 Nov - 2 dec 1988. Order Number DE89013645/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Under sponsorship of the US Department of Energy, Argonne National Laboratory (ANL) is developing high-performance energy transmission fluids that have the potential to substantially reduce frictional losses and improve heat transfer in a variety of thermal systems, allowing the use of smaller piping, pumps, heat exchangers, and storage tanks. This paper presents experimental results and discusses the pressure drop and heat transfer characteristics of non-melting slurry flows. The experimental data obtained in this study improve the fundamental understanding of slurry fluid mechanics and heat transfer, and provide support for the use of slurries as an advanced energy transmission fluids in thermal system applications. 6 refs., 9 figs.

36977 (CONF-890604–12) **A central difference type approximation of convection in fluid flow.** Tzanos, C.P. Argonne National Lab., IL (USA). 1989. 6p. Sponsored by DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Annual meeting of the American Nuclear Society; Atlanta, GA, USA; 4-8 Jun 1989. Order Number DE89013282/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In fluid flow and heat transfer problems, to eliminate instability and oscillations resulting from the numerical approximation of the convection term, it is common practice to use first order upwind differencing. For example, first order upwind differencing is used in codes like COMMIX and PHOENICS. However, in problems characterized by high Peclet numbers this approach is highly inaccurate unless an excessive number of nodes is used. To eliminate this difficulty, a method of grid adaptation using central differencing in one-dimensional problems was presented. In the effort to extend this approach to 2-D and 3-D problems a new method was developed for multidimensional problems that is superior to first order upwind differencing even for a few non-adaptive grid points. This method is presented in this work. 4 refs., 1 fig.

36978 (CONF-890794–1) **Interfacial area measurement methods.** Tan, M.J. Argonne National Lab., IL (USA). 1989. 19p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From 3. American Society of Civil Engineers/American Society of Mechanical Engineers mechanics conference; San Diego, CA, USA; 9-12 Jul 1989. Order Number DE89013426/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Knowledge of local specific interfacial area is required for analysis and prediction of transient and steady characteristics of two-phase flow systems using the two-fluid models. Based on a survey of published work on the subject of specific interfacial area, it is recognized that there is virtually no data base for local specific interfacial area. This report describes the ongoing development of experimental techniques for measurement of local specific interfacial area in gas-liquid and liquid-liquid two-phase systems. Mathematical relations between local specific interfacial area and measurable quantities are derived based on kinematics and geometry. Two methods for determining local specific interfacial area are identified; both entail detection of passage of interfaces through fixed locations in the flow field. A multiple-sensor electrical-resistivity-probe technique is being developed for determination of local specific interfacial area in vertical gas-liquid bubbly flows. The technique consists of simultaneous measurements at two or four locations in the two-phase flow field of the local electrical resistivity of the two-phase mixture. Methods for data analysis are described. Limitations of the technique are briefly discussed. 11 refs., 5 figs.

36979 (CONF-8906131–1) **Time- and volume-averaged conservation equations for multiphase flow.** Sha, W.T.; Chao, B.T.; Soo, S.L. Argonne National Lab., IL (USA). 1989. 20p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 2. international symposium on multiphase flow and heat transfer; Xian, China; 22-24 Jun 1989. Order Number DE89012418/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Governing equations for multiphase flow have been rigorously derived via local volume averaging of single-phase conservation equations of mass, momentum, and energy, followed by time averaging. This averaging procedure leads to a set of differential-integral equations in which the area integrals represent interfacial transport. The spatial averaging theorems are subject to the length scale restriction $d \ll \ell \leq L$, where d, ℓ, and L are, respectively, the characteristic length of the dispersed phase, the averaging volume, and the physical system. The equations presented are appropriate for dispersed systems. 26 refs., 1 fig.

36980 (INIS-SU–76, pp. 10-12) **Comparison of mathematical models of non-equilibrium boiling for calculation of non-stationary processes.** Filin, R.D. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

Various descriptions of non-equilibrium boiling used for the calculation of non-stationary processes in steam-generating channels are compared. It is shown that coincidence of model and object characteristics, which can be attained for the descriptions considered in statics, does not guarantee the coincidence of results in dynamics, due to different dynamical properties of dependences in the descriptions. 7 refs.; 3 figs.

36981 (KFK–4399) **Gas-liquid flow in dividing Tee-junctions with a horizontal inlet and different branch orientations and diameters.** Reimann, J.; Brinkmann, H.J.; Domanski, R. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente; Warsaw Univ. (Poland). Dec 1988. 247p. Order Number DE89788353/JAW. Available from NTIS (US Sales Only), PC A11/MF A01.

An extensive data base is presented, summarizing previous and new experiments, on the phase redistribution and pressure differences for a gas-liquid mixture flowing through the horizontal inlet pipe (diameter D_1=50 mm) of a Tee-junction. Branch to inlet diameter ratios of D_3/D_1 = 1; 0.52; 0.2; and 0.08 were investigated. The branch orientation was horizontal, vertical upward or vertical downward. Mostly air-water experiments were performed with pressures between 0.4 and 1 MPa. Experiments with steam-water flows at pressures between 1.5 and 10 MPa were performed for D_3/D_1 = 1 and a horizontal branch. The results on phase redistribution and pressure drop are compared with other experimental data and model predictions, published previously by various authors. There are clear trends in the experimental data on phase redistribution: For the upward branch, the branch quality x_3 is the highest, for the downward branch the lowest for constant inlet conditions. With decreasing branch diameter, in general, the branch quality increases for the same branch mass flow rate. This tendency can be reversed for $D_3/D_1 << 1$ due to the effect of local phase distribution in the inlet pipe and for $D_3/D_1 \simeq 1$ and inclined branch due to flow reversal effects in the branch pipe.

36982 (UCID–21715) **Stemming temperature changes during emplacement: Experimental results and analysis.** Stein, W.; Comfort, W.J. III. Lawrence Livermore National Lab., CA (USA). May 1989. 24p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89014305/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The process of stemming a deep hole with magnetite, which was initially hotter or cooler than the ambient downhole temperature, was investigated experimentally. The specific objective of the experiment was to determine the temperature changes that occur as the magnetite falls downhole. A numerical model of heat transfer was developed to calculate the stemming temperature changes and was calibrated with the experimental results. Experimental data show that initially hot stemming, 122°F, arrives at a downhole depth of 1284 feet at approximately 74°F when stemmed at 100 tons/hour for an 8 foot diameter hole. Initial downhole temperatures were near 66°F. For initially cold stemming, the temperature of stemming arriving downhole was also close to ambient downhole temperature conditions. The developed calculational model can be applied to predict stemming temperature changes as a function of hole depth, hole diameter, type of stemming material, initial stemming temperature, stemming rate, and ambient hole wall temperature conditions as a function of depth. 8 figs., 5 tabs.

36983 **Modeling of flow fields in oscillating droplets.** Scott, T.C. (Oak Ridge National Lab., Oak Ridge, TN (US)). v.v of Chemical separations. King, J.C.; Navratil, J.D. Litarvin Literature, Arvada, CO (1986). (CONF-860411–: 1. international conference on separations science and technology, New York, New York, USA, 15-17 Apr 1986).

Quantitative and qualitative flow visualization techniques have been used to model flow fields which occur in the droplet-continuum system for liquid-liquid solvent extraction. It was determined that the streamlines for flow in and around oscillating droplets can be modeled as the vectorial addition of low-Reynolds number Hadamard flow and flow caused by an oscillating Dirichlet ellipsoid.

4205 Materials Testing

Refer also to citation(s) 36474, 36479, 36513, 37147

36984 (CONF-890721–25) **Structural integrity evaluation based on an innovative field indentation microprobe.** Haggag, F.M.; Nanstad, R.K.; Braski, D.N. Oak Ridge National Lab., TN (USA). 1989. 7p. Sponsored by DOE/ER;NRC. DOE Contract AC05-84OR21400. From Joint ASME/JSME pressure vessel and piping conference; Honolulu, Hawaii, USA; 23-27 Jul 1989. Order Number DE89010840/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A brief description is given for a field indentation microprobe (FIM) apparatus which was developed to evaluate, nondestructively in situ, the integrity of metallic structures. The FIM consists of an automated ball indentation (ABI) unit for determining the mechanical properties (yield strength, flow properties, fracture toughness, etc.) and a nondestructive evaluation (NDE) unit (consisting of ultrasonic transducers and a video camera) for determining the physical properties such as crack size, material pile-up around indentation, and residual stress presence and orientation. The laboratory version used here performs only ABI testing. Results of the laboratory version of the FIM tests on unirradiated and irradiated A212 grade B pressure vessel steel are discussed in this paper. Excellent agreement was obtained between yield strength and flow properties (true-stress/true-plastic-strain curve) measured by the ABI tests and those of uniaxial tensile tests. 14 refs., 9 figs., 1 tab.

36985 **Intergranular fracture in metals.** Briant, C.L. (General Electric Co., Schenectady, NY (USA)). pp. 22 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

This paper concerns brittle intergranular fracture in metals. It is shown that the primary cause of intergranular fracture is impurity segregation. However, the ability of a given concentration of an embrittling species to cause fracture can be modified by many factors. These include the orientation of the grain boundary with respect to the stress axis, the structure of the grain boundary, the presence of second phase particles, and the general mechanical response of the material. It will be shown that intergranular fracture can be considered as a simple dissociative chemical reaction and models to explain the bond weakening caused by impurities will be discussed.

36986 **Subcritical crack growth in metal-ceramic-interfaces.** Mueller, M. (Max-Planck-Institut fuer Metallforschung, Stuttgart (West Germany)); Kromp, K.; Gerold, V. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

A method is presented to investigate the adhesion strength of thin metal films on alumina substrates. For this purpose the extension behavior of an interface crack in the composite was observed in a 3-point bending test. The composite consists of a 96% alumina and AgPd-alloy with a thickness of 10-50 μm. A compound system is produced from the composite by glueing alumina blocks to the alumina substrate and to the metal film respectively. Bending specimens are cut out of this compound system and are notched near the interface layer. By asymmetrical preloading an interface crack is produced as a crack starter. During the following bending test the controlled crack-extension is observed with a travelling microscope. The load-displacement diagram and the optically measured crack length are used to calculate the crack resistance R, which characterizes the adhesion strength of the metal film.

36987 **Hydrogen embrittlement in grain boundaries studied by fatigue crack propagation in Al-Zn-Mg bicrystals.** Niegel, A. (Max-Planck-Institut fuer Metallforschung, Stuttgart (West Germany)); Gudladt, H.J.; Gerold, V. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

High cycle fatigue crack propagation in grain boundaries was studied in precipitation hardened Al-Zn-Mg specimens containing a single grain boundary (gb) perpendicular to the load axis. In peak-aged bicrystals tested in wet nitrogen atmospheres, cracks propagated in an intercrystalline manner. Under cyclic loading conditions two different mechanisms contribute to crack propagation which are termed stress corrosion cracking (SCC) and intergranular corrosion fatigue (CF). In both cases, it is well established that intercrystalline crack propagation is influenced by hydrogen penetrating into the gb during each load cycle. For SCC it is the hydrogen dissolved into the gb, resp. areas close to the boundary whereas for CF it is the trapped hydrogen which initiates the intergranular cracking. Both terms will be discussed under microstructural aspects.

36988 **Cyclic migration and fracture in solid solution alloys.** Raman, V. (TJ Watson Research Center, Yorktown Heights, NY (USA)); Langdon, T.G. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988).

(CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The role of grain boundary processes during fatigue testing at high temperatures has been studied in several pure metals. This paper summarizes grain boundary behavior in Al-3% Mg and Pb-2% Sn solid solution alloys deformed in fatigue at high temperatures. It is shown that there are significant differences in the processes occurring at grain boundaries in these alloys compared to those observed in pure metals. The implications of these observations in influencing high temperature fatigue fracture are discussed.

36989 (INFO–0249) **Fresh fuel verification feasibility study.** Atomic Energy Control Board, Ottawa, ON (Canada); BOT Engineering Ltd., Campbellville, ON (Canada). Jul 1987. 133p. Order Number DE89620174/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

The study examined several methods of verifying crates of fresh CANDU fuel without opening the crates. Of these methods only a passive gamma techniques and an active neutron technique were chosen as being appropriate. Computer simulation supported by physical measurements were performed to determine the applicability of various detectors, detector configurations, detector locations, etc. The results indicate that for the two techniques chosen a crate of fuel can be verified without its being opened provided modifications are made to the crate to permit a detector or source probes to be inserted. Estimates of the cost of modifying existing crates and procuring the measurement equipment are provided.

36990 (INIS-mf–11451) **Welding '88. Nondestructive testing of welded joints.** Ceskoslovenska Vedeckotechnicka Spolocnost, Bratislava (Czechoslovakia). Dom Techniky. Mar 1988. 138p. (In Slovak, Czech). (CONF-8803218–: Welding '88 - 3. conference on nondestructive testing of welded joints, Brno, Czechoslovakia, 3-4 Mar 1988). Order Number DE89618174/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

The proceedings of the international conference Welding '88 held in Brno (CS) on March 3 and 4, 1988 contains the full texts of 23 papers of which 11 fall under the INIS scope. (Z.M.).

36991 (INIS-mf–11982, pp. 15.1-15.16) **Benefits offered by an advanced US-technique in describing faults (ALOK).** Dressler, K. (Rheinisch-Westfaelischer Technischer Ueberwachungs-Verein e.V., Essen (Germany, F.R.)); Werden, B. Staatliche Materialpruefungsanstalt, Stuttgart (Germany, F.R.); Rheinisch-Westfaelischer Technischer Ueberwachungs-Verein e.V., Essen (Germany, F.R.). 1987. (In German). (CONF-8710410–: 13. MPA seminar on safety and reliability of pressure components: the contribution of component and large specimen testing to structural integrity assessment methodology, Stuttgart, Germany, F.R., 8-9 Oct 1987). In *Safety and reliability of pressure components with special emphasis on the contribution of component and large specimen testing to structural integrity assessment methodology. Vol. 1. Fracture mechanics, dynamic loading, nondestructive testing, radiation embrittlement.* Order Number DE89783126/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The amplitude and transit time-locus curves (ALOK) are used to assess recorded ultrasonic signals. This not only includes the investigation of the amplitude variations which occur whilst shifting the detector relative to a reflector, but also the simultaneously occurring changes in the sonic pulse transit times. The ALOK-3 device was developed for small-scale production which incorporates an automated ultrasonic test-system and a complete computed read-out for data evaluation. The use of this compact device is not confined to the field of specialized analytic investigations of nuclear reactor components.

36992 (KURRI-TR–309) **Report on the instrumented Charpy impact test for metallic materials.** Kozuka, Toshihiko; Yoshida, Hiroyuki. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Dec 1988. 25p. (In Japanese). Order Number DE89790848/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

An instrumented testing method has been developed for Charpy impact test for steels, aluminum alloys and other materials. Using the instrumented Charpy testing machine developed, it is clearly estimated that the method is good enough to give us detailed information about the impact properties of these metallic materials.

36993 (PB–89-861215/XAB) **Nondestructive testing for microelectronics, semiconductors, and superconductors. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989.** National Technical Information Service, Springfield, VA (USA). May 1989. 161p. Available from NTISPC N01/MF N01.

Supersedes PB–87-854295.

This bibliography contains citations concerning the theory and various techniques for nondestructive testing or examination of microelectronic devices, semiconductor devices, and superconductors for the detection of flaws or defects that affect their properties and behavior. Some attention is also given to uniformity and quality control in integrated-circuit manufacturing. (This updated bibliography contains 319 citations, 93 of which are new entries to the previous edition.)

36994 (RFP–4297) **A comprehensive guide to the literature on acoustic emission from composites: Supplement 2.** Drouillard, T.F. Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant. 25 Apr 1989. 22p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP03533. (CONF-890789–1: 3. international symposium on acoustic emission from reinforced composites, Paris, France, 17-21 Jul 1989). Order Number DE89013524/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Comprehensive bibliographies on the subject of acoustic emission (AE) from composites were compiled for the First and Second International Symposiums on Acoustic Emission from Reinforced Composites which were held in San Francisco, California, July 19-21, 1983, and Montreal, Canada, July 21-25, 1986. The current bibliography is the third in the series. It presents 212 references of new material. The material is presented in the same format as previously used, which consists of a bibliographic section, an author index, and a subject index. Although not all-inclusive, this series of bibliographies presents a compilation of the bulk of world literature published on the subject of acoustic emission from composites.

36995 (SAND–89-0343C) **Strain to failure of pressurized thick wall cylinders.** Priddy, T.G.; Roach, D.P. Sandia National Labs., Albuquerque, NM (USA). 1989. 20p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890721–20: Joint ASME/JSME pressure vessel and piping conference, Honolulu, Hawaii, USA, 23-27 Jul 1989). Order Number DE89009969/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The determination of the fully plastic response and pressure limit of a highly pressurized vessel is of considerable importance in design. The plastic-strain response during and following autofrettage operations, in comparison with the limiting strain condition, is of special interest. This paper presents the results of an analysis method for thick wall, high pressure, cylinders where the effective plastic strain distribution through the thickness is the material response variable of primary interest. The limiting value of this effective plastic strain depends on the level of tensile-stress triaxiality which also varies through the thickness. This strain-to-failure criterion is used to predict the complete pressure versus strain response and the maximum pressure for test cylinders. A simple model of effective-stress versus effective plastic strain is employed. This model is quantified by data taken from uniaxial, tension, true-stress-strain curves and from the fracture zone of the tensile specimen. A sample calculation is included and, in a companion paper, a series of burst tubes having properties ranging from brittle to ductile are compared with this analytical method. 21 refs., 5 figs., 2 tabs.

36996 (SAND–89-0727) **Description of the NanoΔIndenter™; An ultra-low-load microhardness indentation test machine.** Schmale, D.T.; Bourcier, R.J. Sandia National Labs., Albuquerque, NM (USA). Jun 1989. 25p. Sponsored by DOE Nuclear Energy. DOE Contract AC04-76DP00789. Order Number DE89014608/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report provides an introduction to the capabilities of a new experimental test system recently acquired by Department 1830 and installed into the Organization 1000 bay of the microelectronics

Development Laboratory, Building 858. This device - the Nano∆Indenter{Trademark} - is a state of the art ultra-low load indentation hardness tester. It is a computer-controlled load and depth sensing instrument with depth resolution of 0.2 nm and load resolution of 0.3 μN. Initial testing has now been performed using this machine, verifying that it will be a unique addition to our existing mechanical test capabilities. 3 refs., 8 figs.

36997 (SAND–89-1406C) **Ultrasonic systems and system development at SNL Albuquerque.** Shurtleff, W.W. Sandia National Labs., Albuquerque, NM (USA). 1989. 11p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8906139–1: 31. weapons agencies nondestructive testing organization, Kansas City, MO, USA, 5-9 Jun 1989). Order Number DE89013164/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

With completion of the High Precision Ultrasonic Scanning System (HPUSS) and purchase of the Olympus acoustic microscope, the SNL Albuquerque NDE divisions now have the capability to ultrasonically scan almost any size and shape of test object. The general purpose ultrasonic scanning system, the high precision ultrasonic scanning system, and the acoustic microscope cover a wide resolution and magnification range. The rest of this paper describes the three systems in more detail and talks about future ultrasonic system development at Sandia. 5 figs.

36998 (UCRL–101051) **A proposal of more expedient methods of testing machine tools.** Hauschildt, H.E. Lawrence Livermore National Lab., CA (USA). 10 May 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8905158–1: IMOG maintenance subgroup, Denver, CO, USA, 17-18 May 1989). Order Number DE89013033/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In the continuing search for more efficient means of testing machine tools, there are some recent experiences that should be shared. This report will discuss techniques, some old, some new, that are worthwhile evaluating for application as part of a machine tool maintenance function.

4208 Electronic Circuits and Devices

Refer also to citation(s) 35975, 36244, 36595, 36687, 36993, 37135, 37734, 37806

36999 (AD-A–205141/5/XAB) **Thin-film optics for signal-processing applications. Final report, 1 September 1986-31 May 1988.** Warde, C. Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Electrical Engineering and Computer Science. 25 Jan 1989. 6p. Available from NTIS, PC A02/MF A01.

High-resolution, high-speed, spatial light modulators that offer excellent spatial uniformity are the key devices impeding progress in the areas of optical information processing and computing. The thrust of the MIT research effort is in the area of materials, devices, and systems for optical information processing. The research is focused on (1) growth, processing, and characterization of optical crystals for spatial light modulation, (2) spatial light modulator prototype device development, and (3) applications of spatial light modulators in symbolic optical processors. This final report describes the purchase, assembly, and operation of an RF sputtering system that is supporting a number of these and other DOD-sponsored research programs at MIT.

37000 (CONF-890744–1) **Tool integration and enhancement for standard cell designs.** Britton, C.L. Jr.; Alley, G.T.; Bryan, W.L.; Emery, M.S.; Ericson, M.N.; Bouldin, D.W.; Newport, D.F. Oak Ridge National Lab., TN (USA). 1989. 14p. Sponsored by Department of Defense. DOE Contract AC05-84OR21400. From VLSI education conference and exposition; Santa Clara, California, USA; 19-21 Jul 1989. Order Number DE89007516/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Application-specific integrated circuits designed using standard cells minimize the training and development time for engineers while maximizing the likelihood of obtaining functional silicon. By integrating and enhancing existing computer-aided design tools, it is now possible to support this methodology with a low-cost set of tools that also makes optimum use of computing resources. Personal computers are used for schematic capture and logic-level simulation, while engineering workstations are used for physical placement and routing as well as switch-level simulation, timing analysis, and fault grading. Examples of projects implemented using this tool set are given. 2 figs., 15 refs.

37001 (CONF-8906133–1) **A remote sensor/cable identifier.** Andrews, W.H. Jr.; Baker, S.P. Oak Ridge National Lab., TN (USA). 1989. 5p. Sponsored by National Aeronautics & Space Administration. DOE Contract AC05-84OR21400. From 15. transducer workshop; Cocoa Beach, FL, USA; 20-22 Jun 1989. Order Number DE89013050/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Errors in field wiring can result in significant correction costs in erroneous or unusable data, or in serious accidents. Detailed field wiring checkout and rework are tedious and expensive, but they are essential steps in the quality assurance process for large, complex instrumentation and control systems. A recent Oak Ridge National Laboratory (ORNL) development, the remote sensor/cable identifier (RSCI), automates verification of field wiring. In the RSCI system, an identifier module is installed on or integrated into each component (sensor, actuator, cable, distribution panel, etc.) to be verified. Interrogator modules, controlled by a personal computer (PC), are installed at the connections of the field wiring to the inputs of the data acquisition and control system (DACS). Interrogator modules poll the component connected to each channel of the DACS and are able to determine the path taken by each channel's signal to or from the end device for that channel. The system will provide not only the ID code for the cables and patch panels in the path to a particular sensor or actuator, but individual cable conductor IDs as well. One version of the system uses existing signal wires for communications between RSCI modules. Another, more powerful version requires a dedicated conductor in each cable. Both versions can operate with or without instrument power applied, and neither interfaces with the normal operation of the DACS. Identifier modules can provide a variety of information including status and calibration data. 3 figs.

37002 (LA-UR–89-489) **Reliability estimates for large satellite memories in low earth orbits.** Evans, E.P.; Roeske, S.B.; Browning, J.S.; Holtkamp, D.B.; Stoddard, G.B. Los Alamos National Lab., NM (USA). 1989. 4p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890723–6: 26. annual conference on nuclear and space radiation effects, Marco Island, Florida, USA, 24-28 Jul 1989). Order Number DE89007764/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

Los Alamos and Sandia National Laboratories are building an ultrasoft x-ray space telescope experiment, designed to be flown on a "cheap-sat." Reliability estimates for the combined total dose and single event environments are given for the on-board memories as large as 1 gigabit. 4 refs., 4 figs., 1 tab.

37003 (LA-UR–89-1905) **Calculational evaluation of plasma flow switches for the Los Alamos Foil Implosion Project.** Greene, A.E.; Bowers, R.L.; Oliphant, T.A.; Peterson, D.L.; Weiss, D.L. Los Alamos National Lab., NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890665–33: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, CA, USA, 12-14 Jun 1989). Order Number DE89014028/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The next system design under consideration for the Los Alamos Foil Implosion Project (Trailmaster) is projected to deliver in excess of 15 MA of electrical current produced by high-explosive driven flux compression generators to a foil load. A plasma flow switch is being investigated as the final pulse shaping step in this system. The performance of these switches is being evaluated using a wide variety of computational tools including zero-, one- and two-dimensional MHD codes and a 3-D view-factor radiation transport code. We are concerned with the effects of radiation from the switch plasma prior to switching current to the load, and the interaction of the switch plasma on existing perturbations and as a source of perturbation on the imploding load. 4 refs. 6 figs.

37004 (LA-UR–89-1911) **The Mark IX generator.** Fowler, C.M.; Caird, R.S. Los Alamos National Lab., NM (USA). 1989. 5p.

Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890665–32: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89014026/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A large, explosive helical generator (the Mark IX) is described. The stator ID is 35.6 cm and the armature OD is 17.3 cm. The overall length is 112 cm. This generator delivered 11, 23.5, and 30 MA to 120-, 56-, 35-nH loads, respectively. A Marxing technique is used that enables us to employ over 1 MJ of capacitor bank energy for the initial current without destroying the generator prematurely by magnetic forces. The shot data were analyzed by first computing the generator inductance vs. time curve and then deriving the resistance vs. time curve from the data. This approach yields a useful characterization of the generator. 5 refs., 7 figs., 1 tab.

37005 (LA-UR–89-1941) **High voltage power condition systems powered by flux compression generators.** Reinovsky, R.E.; Lindemuth, I.R.; Vorthman, J.E. Los Alamos National Lab., NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890665–29: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, CA, USA, 12-14 Jun 1989). Order Number DE89014259/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Compact, high-gain magnetic flux compressors (FCGs) are convenient sources of substantial energy for plasma-physics and electron-beam-physics experiments, but the need for high-voltage, fast-rising pulses is difficult to meet directly with conventional generators. While a variety of novel concepts employing simultaneous, axially- detonated explosive systems are under development, power-conditioning systems based on fuse opening switches and high-voltage transformers constitute another approach that complements the fundamental size, weight, and configuration of the small helical flux compressor. In this paper, we consider first a basic inductive store/opening switch circuit and the implications associated with, specifically, a fuse opening switch and an FCG energy source. We develop a general solution to a transformer/opening switch circuit—which also includes (as a special case) the direct inductive store/opening switch circuit (without transformer) and we report results of one elementary experiment demonstrating the feasibility of the approach. 9 figs.

37006 (LA-UR–89-1990) **Exploding metallic foils and fuses: A computational modeling update.** Lindemuth, I.R.; Reinovsky, R.E. Los Alamos National Lab., NM (USA). 1989. 16p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890665–27: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, CA, USA, 12-14 Jun 1989). Order Number DE89014033/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Los Alamos computational model of exploding metallic foil behavior has been used to analyze and design a wide range of experiments in which exploding metallic foils were driven by the output current of capacitor banks and magnetic flux compression generators. Currents in the experiments ranged from 1 kA-16 MA and foil conduction times ranged from 200 ns-300 μs. The successes and limitations of the computational models are surveyed. 18 refs., 6 figs.

37007 (LA-UR–89-1992) **Explosively formed fuse opening switches for use in flux-compression generator circuits.** Goforth, J.H.; Marsh, S.P. Los Alamos National Lab., NM (USA). 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890710–15: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014034/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Explosive-driven magnetic flux compression generators (explosive generators) provide for the generation of large amounts of energy compactly stored in a magnetic field. Opening switches for use in explosive generator circuits allow the energy to be used for applications requiring higher power than can be developed by the generators themselves. We have developed a type of opening switch that we describe as an explosively formed fuse (EFF). These switches are well suited to explosive generator circuits and provide a considerable enhancement of explosive pulsed-power capability. 10 refs., 14 figs.

37008 (LA-UR–89-2097) **A battery-powered flux compression generator system.** Vorthman, J.E.; Fowler, C.M.; Hoeberling, R.F.; Fazio, M.V. Los Alamos National Lab., NM (USA). 1989. 6p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-36. (CONF-890710–5: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014230/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Flux compression generators (FCGs) are primarily used as energy amplifiers. While a FCG can be made small, typically the "seed" energy that the FCG amplifies comes from a capacitator bank much larger and heavier than the FCG. If seed energy was supplied by a compact device, FCGs could be used as portable power supplies. One application of interest is to combine a compact seed source with a FCG and transformer. The result would be a self-contained power supply capable of producing a microsecond long, megavolt pulse. The objective of the work described in this paper was to make a seed source capable of energizing a standard Los Alamos plate FCG. The power supply was to be relatively small, light weight, and able to deliver at least 100-kJ to a 280-nH inductive load, e.g., plate FCG. 4 figs., 2 tabs.

37009 (LA-UR–89-2106) **High-voltage pulsed transformer development.** Freeman, B.L.; Rickel, D.G.; Ramrus, A.; Strickland, B.E. Los Alamos National Lab., NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890710–6: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014227/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The theoretical designs for tape-wound, step-up transformers reported by Freeman and Bostick have been converted into physical units that have been subjected to experimental testing. The physical design of these transformers is relatively simple and uses common materials. The winding is composed of copper foil and Kapton film. The impregnating fluids have been fluorinert, propylene carbonate, and propylene carbonate with iron chloride. While several transformers were tested using a capacitor bank as the driver, most experiments have been driven with the 13.2-cm-wide by 52.8-cm-long plate generator. In these tests, both passive and active loads, ranging in impedance from 1.3 Ω to 200 Ω, have been energized. Reliable operation to 500 kV has been achieved with an associated voltage stress of $\leq$1.6 MV/cm. Effective coupling coefficients in the range of 0.85-0.92 have been measured. Results of this testing and prospects for further improvement are presented. 4 refs., 6 figs.

37010 (LA-UR–89-2137) **Disk generator with nearly shockless accelerated driver plate.** Fowler, C.M.; Hoeberling, R.F.; Marsh, S.P. Los Alamos National Lab., NM (USA). 1989. 9p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-36. (CONF-890710–12: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014220/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The "disk" generator was first conceived here as a useful magnetic field source for a class of in situ plasma experiments. Initial current is supplied (from a capacitor bank) to the generator through radial coaxial cables. It enters the top plate, passes through the central post, and exits through the top of the outer cylindrical glide surface, which is insulated from the top plate. The explosive over the top plate is initiated simultaneously over its upper surface at such a time that the top plate starts its downward motion at about peak initial current. Generators of this class were first developed by Chernyshev, Protasov, and Shevtsov who called them "disk" generators, the name we have adopted here. Design details of the generator are given in Sec. II. They are based in considerable part on two-dimensional hydrodynamic calculations. Shot results are summarized in Sec. III, together with a discussion of the data obtained. 3 refs., 7 figs.

37011 (LA-UR–89-2163) **A simultaneous helical generator.** Rickel, D.G.; Freeman, B.L.; Fowler, C.M.; Vorthman, J.E.; Marsh, S.P. Los Alamos National Lab., NM (USA). 1989. 8p. Sponsored by

Department of Defense. DOE Contract W-7405-ENG-36. (CONF-890710–4: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014284/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A need is emerging for a class of short-pulse, high-voltage, magnetic flux compression generators (FCGs). It is desirable that these generators be compact, inexpensive and have modest prime power requirements. Toward this end several concepts have been worked on in our Laboratory, one of which is the conical helical generator described in this paper. 5 figs.

37012 (LA-UR–89-2169) **Plasma flow switch characterization for the Los Alamos Foil Implosion Project.** Bowers, R.L.; Brownell, J.H.; Greene, A.E.; Peterson, D.L. Los Alamos National Lab., NM (USA). 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890710–2: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014279/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The next system design under consideration for the Los Alamos Foil Implosion Project is projected to deliver tens of mega-amperes of electrical current produced by high-explosive driven flux compression generators on a time scale of about one microsecond to a load foil. The use of such generators, with time scales of order several tenths of a millisecond, leads to considerable pulse shaping problems. Previously it was noted that a commutating switch might serve as an efficient alternative to a closing switch in transferring current from a coaxial transmission line to a cylindrically imploding load. Research at the Air Force Weapons Laboratory (AFWL) has met with considerable success in efficiently transferring currents of order 10 MA to an imploding liner using the plasma flow switch concept (PFS). Besides efficiently transferring current, the plasma flow switch protects the load region from high voltages generated by an opening switch until the current is present to provide magnetic insulation. For these reasons, a PFS is being investigated as the final pulse shaping step in the design. A series of capacitor bank experiments is also being fielded to help investigate physics issues and to benchmark the codes. 4 refs., 7 figs.

37013 (LA-UR–89-2194) **High-performance, high-current fuses for flux compression generator driven inductive store power conditioning applications.** Reinovsky, R.E.; Lindemuth, I.R.; Goforth, J.H.; Caird, R.S.; Fowler, C.M. Los Alamos National Lab., NM (USA). 1989. 21p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-36. (CONF-890710–7: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014274/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Large-scale helical flux compression generators deliver energies in the range of 10–50 MJ in economical, flexible packages for powering a variety of plasma and electron beam experiments. While conventional, end-detonating, helical generators are simple and reliable, they have the disadvantage of delivering their energy over long timescales, up to 400–500 μs, and at relatively low output voltages. Many experiments require faster risetimes than can be delivered by a helical FCG directly, and inductive systems utilizing high current interrupting switches can be employed to match generator performance to load requirements. For this experiment, a 15-MJ class helical flux compression generator was selected as the primary energy source. This flux compressor is a modification of a design proposed by Pavlovski in 1979 and used routinely in Los Alamos programs. The generator consists of a multiple conductor, multiple pitch, helical stator and a hollow copper armature containing a 60-kg charge of PBX 9501 high explosive (HE) which is initiated by a small plane wave lens at the end opposite the output. 8 refs., 12 figs.

37014 (ORNL/TM–10979) **A symbolic generator of state equations for modeling of dynamic systems based on the electrical network analog paradigm.** Depiante, E.V. Oak Ridge National Lab., TN (USA). Mar 1989. 39p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE89013763/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The capability of automatically generating state equations for a given system is a desirable component of an integrated environment for system control and simulation studies. A step towards the development of this capability is described in the following sections. Section 2 presents the statement of the problem to be solved. Since the solution approach involves the use of circuit analogs topology concepts are required; these are presented in Section 3. The governing network equations and different network formulations are given in Section 4. The problem of systematically formulating the state equations is the topic of Section 5. A program (SEQS) developed to automatically generate the state equations is described in Section 6 and its application is illustrated in Section 7. Section 8 contains the conclusions. Appendix A gives a listing of the SEQS program and Appendix B gives a sample input file for the SEQS program. 6 refs., 4 figs., 2 tabs.

37015 (SAND–89-0037) **LineCAP [Line/Circuit Analysis Program]: Cross-coupling on PC [printed circuit] board traces including discontinuities and circuit elements.** Bacon, L.D.; Toth, R.P. Sandia National Labs., Albuquerque, NM (USA). Jun 1989. 42p. Sponsored by DOE Energy Research. DOE Contract AC04-76DP00789. Order Number DE89013884/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A program has been written that allows us to predict the trace-to-trace cross-coupling on printed circuit boards for many geometries of practical interest. It combines multiconductor transmission line analysis with circuit analysis in the time domain. Multiple sections of uniform lines, of varying number and characteristics, can be interconnected by passive circuit elements. These circuit elements may represent physical components or the effects of discontinuities in the lines. These predictions were compared with measurements for simple geometries, with good agreement in both waveshape and amplitude. The major discrepancies were in the amplitudes of fast rising spikes and are probably due to the fact that the predictions did not account for the increasing attenuation at high frequencies. 10 refs., 12 figs.

37016 (SAND–89-0068C) **Numerical analysis of experimental data to infer plasma opening switches.** Moore, W.B.; McDaniel, D.H.; Mowrer, G.R.; Rochau, G.E. Sandia National Labs., Albuquerque, NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890665–22: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89014489/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Plasma Opening Switch (POS) experiments to support Sandia National Laboratories PBFA II ion beam accelerator were conducted on Maxwell Laboratories Blackjack 5 accelerator. The first experiment tested an improved flashboard plasma source to generate a uniformly opening POS. The results showed that the J x B force caused plasma motion into the diode load region prior to the opening of the POS. Plasma motion was inferred by comparing experimental data to circuit models which used a variable resistance POS and a variable inductance (L-dot) term. The L-dot term was necessary in the model to reproduce the experimental results. 4 refs., 13 figs.

37017 (SAND–89-0292C) **Photocurrent variability of discrete bipolar devices.** Huffman, D.D.; Wrobel, T.F.; Hospelhorn, R.L.; Willis, D. Sandia National Labs., Albuquerque, NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890723–8: 26. annual conference on nuclear and space radiation effects, Marco Island, Florida, USA, 24-28 Jul 1989). Order Number DE89008227/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Thirty-nine (39) bipolar device lots (195 devices) were tested for peak photocurrent. Difference in average photocurrent between lots of same device types was less than a factor of three in all cases. 4 figs.

37018 (SAND–89-1569C) **Standard terminal panel and UPS [uninterruptible power supply] design for exterior intrusion detectors and data collection applications.** Wolfenbarger, F.M. Sandia National Labs., Albuquerque, NM (USA). 1989. 11p.

Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–16: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, Florida, USA, 9-12 Jul 1989). Order Number DE89014487/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Need for standardization has been discussed for years by many government agencies. In the past, every perimeter site upgrade resulted in the design, specification, procurement, and fabrication of a unique power and signal junction box. To save design and specification cost, a standard terminal panel and uninterruptible power supply (UPS) design for an exterior intrusion sensor detection system was developed for a security system within the Sandia National Laboratories complex at Albuquerque, New Mexico. In facilitating this requirement a design was sought that could easily be modified for other government or commercial applications and one that could easily be fabricated in the shop. Also of primary importance was the need for lightning protection for both the communications and voltage sources. A 12V dc UPS with a current capacity of up to 4 amperes complements the standard terminal design and allows uninterrupted sensor operation for a number of hours should the primary ac source be interrupted. This report encompasses the features of the designs. The designs are also being used and continuously evaluated in Sandia's Area III exterior test field. 7 figs.

37019 (UCRL–100361) **Vacuum insulator failure measurements and improvement.** Vogtlin, G.E.; Vernazza, J.E. Lawrence Livermore National Lab., CA (USA). Jun 1989. 4p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890665–34: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, CA, USA, 12-14 Jun 1989). Order Number DE89014269/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Cones, cylinders, and insulators have been tested with a 3 nanosecond full width halfmax pulse. These insulators were made of epoxy, acrylic, lexan, and nylon. The tests were conducted with cone insulators at +45 degrees, –45 degrees, and 0 degree. Additionally, tests were conducted with a plug in the anode that reduces the anode stress, and anodized cathodes. Best results were obtained with both an anodized cathode and an anode plug where failure was through the solid dielectric at 600 kV/cm. Results of this testing will be presented. Explosive emission was also evaluated with the same apparatus. All tests were conducted without conditioning. Currents could be detected down to 10 milliamps. Data for brass, copper, stainless, aluminium will be presented. The onset of explosive emission could be detected. The lowest onset was for brass at less than 200 kV/cm. The best was a carbon loaded epoxy emission. Currents have been detected that follow a Fowler-Nordheim like function of voltage. 6 refs., 3 figs.

37020 Real-time optical processor for synthetic aperture radar image formation. Stalker, K.T. (Sandia National Labs., Albuquerque, NM (US)); Molley, P.A.; Dickey, F.M. v.v of Optical technology for microwave applications III. Yao, S.K. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1987). (CONF-8705248–: 3. optical technology for microwave applications meeting, Orlando, FL, USA, 19-20 May 1987).

An acousto-optic processor which forms synthetic aperture radar images in real-time is described. It employs a space and time integrating architecture to perform the required two dimensional matched filtering operation as a sequence of one dimensional processes. The matched filtering in range is performed on each radar return pulse using the acousto-optic device. The azimuthal matched filtering is performed using a fixed reference mask and a charge-coupled device operating in the time delay and integrate mode. This fixed mask architecture has been modified to include a background subtraction capability to reduce the effects of unwanted bias terms on image quality. The effectiveness of this technique is analyzed for two different time bandwidth product cases. SAR imagery formed using the real-time optical processor is presented.

37021 Transition metal oxide electrochemical capacitors. Raistrick, I.D. (Los Alamos National Lab., Los Alamos, NM (US)); Beery, J.G.; Sherman, R.J. v.v of Electro-ceramics and solid-state ionics. Tuller, H.L.; Smyth, D.M. The Electrochemical Society, Pennington, NJ (1987). (CONF-8710306–: Symposium on electro ceramics and solid state ionics, Honolulu, HI, USA, 18-23 Oct 1987).

The electrical response of electrochemical capacitors based upon ruthenium dioxide is discussed and compared with that of similar devices based upon high surface carbon. Equivalent electrical circuits are proposed that approximate the response of the two types of device. The effects of fabrication and electrolyte variables on the small-signal ac impedance are described.

4209 Waste Processing Plants and Equipment

Refer also to citation(s) 37168, 37169

4210 Combustion Systems

Refer also to citation(s) 35589, 35591, 36412

37022 (CANMET–8712) **Tube wastage in FBC boilers at Summerside - causes and resolution.** Razbin, V.V.; Friedrich, F.D. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). 1987. 43p. (MICROLOG–88-06056). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Canada's first application of fluidized bed technology to the combustion of coal was a heating plant, completed late in 1982, at Canadian Forces Base Summerside, Prince Edward Island. The plant consists of two bubbling bed boilers, rated at 18,000 kg/h of medium pressure steam, and fired with high sulphur content coal. Although startup problems were numerous, by the end of the first two heating seasons the boilers had met all guarantees concerning capacity, efficiency, and emissions. However, wastage of the heat exchange surfaces exposed to the bed had become evident by the second month of operation. Several corrective measures were implemented with varying degrees of success. Ultimately, two configurations of protective hardware were found to be effective: closely-spaced pin studs on the waterwalls, and longitudinal rods, five per tube, on the inbed tubes. This paper provides chronological data on the metal wastage in the Summerside boilers. The effects of air jets, large particles, location of inbed tube bundles, and several forms of protective hardware are discussed. Also described is a current experiment with the inbed tube bundle. Since the fall of 1985, the boilers have been operating successfully with no significant tube wastage. 3 refs., 20 figs., 5 tabs.

37023 (SAND–89-1385C) **A recuperative gas fired forge furnace.** Gunter, R.; Schuler, K.W.; Ward, R.L. Sandia National Labs., Albuquerque, NM (USA). 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8906143–1: Western states forging conference, Carbondale, CO, USA, 5-7 Jun 1989). Order Number DE89013448/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

To overcome the heat deficit and oxidizing atmosphere problems and to reduce fuel consumption, a small gas forge furnace has been developed which incorporates recuperative heating; as the combustion air is drawn into the furnace it is preheated by passing it through a simple heat exchanger which is heated by the exhaust gases from the furnace. This recuperative heating principle is the same used by blast and open hearth furnaces but they typically employ complex heat exchangers, and extensive blowers and valving to direct the flow of the intake and exhaust gases. In the furnace described in this article a chimney is provided at the rear of the furnace and the air intake ducts pass through the chimney before reaching the venturi where the fuel gas is injected. Thermocouples were place in the air intake ducts and the temperature of the recuperated air was 1000 F. Based on data in the Mechanical Engineers Handbook (Industrial Heating Furnaces) fuel savings are directly related to the temperature of the preheated air. The theoretical saving in fuel with 800 F. combustion air is about 19%. The furnace is very quiet, since no blowers are used and the venturi is located in the center of a long tube. To control the furnace atmosphere and to help reduce heat loss, a close fitting swing away door has been incorporated, and the entire furnace is insulated with lightweight high performance ceramic insulation. The resulting furnace easily achieves forge welding temperatures, has an oxygen

depleted atmosphere and has proven to be very effective and capable for small machine and hand forging operations. 6 figs.

37024 (SC–8706) **The influence of termination configuration on the flow performance of flues.** Haysam, J.C.; Swinton, M.C.; Wilson, A.G.; White, J.H. Scanda Consultants Ltd., Ottawa, ON (Canada). 1987. 67p. (MICROLOG–88-06257). Available from Canada Mortgage and Housing Corporation, Annex Bldg., 628 Montreal Rd., Ottawa, ON, Canada K1A 0P7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Wind tunnel tests were conducted on a number of common configurations of furnace and fireplace flue terminations to determine the horizontal and vertical wind pressure coefficients for each configuration for a range of wind attack angles and to determine the restriction to flue flow created by each configuration. The results indicate the following: for any given set of wind conditions, there are wide variations in the performance of various chimney caps, in terms of their likely effect on the combustion venting performance of the chimney; and, in deciding to use a cap on a particular chimney and in choosing a particular cap to use, the wind conditions likely to prevail at the top of the chimney and the performance characteristics of the candidate caps should be taken into account. To facilitate the informed selection of flue caps, it is suggested that Canadian standards related to flue caps be modified to incorporate detailed performance testing and rating of caps. The test data were organized in a manner that would facilitate its use in calculations and modelling such in the FLUE SIMULATOR computer program. 3 refs., 21 figs., 8 tabs.

37025 (SC–8708) **The influence of flue sharing on venting performance.** Haysom, J.C.; Swinton, M.C.; Wilson, A.G.; White, J.H. Scanda Consultants Ltd., Ottawa, ON (Canada). 1987. 94p. (MICROLOG–88-06476). Available from Canada Mortgage and Housing Corporation, Annex Bldg., 628 Montreal Rd., Ottawa, ON, Canada K1A 0P7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

An investigation of the effect of the sharing of flues by furnaces and water heaters on the performance of venting systems serving natural gas appliances was conducted. The investigation comprised: a literature review, a review of applicable codes and standards, controlled field testing to investigate the effect of various water heater vent connector configurations on venting performance, modification of the FLUE SIMULATOR computer model to allow it to model shared flue venting systems, calibration of the modified FLUE SIMULATOR model using the results of the field tests, use of the FLUE SIMULATOR model to predict the effect of flue sharing on venting performance in a variety of situations, and development of guidelines for heating industry service personnel. The results of this study indicate that the sharing of flues greatly exacerbates venting problems when the conditions for proper venting are already adverse. This makes it important that both the furnace and the water heater vent connectors have "clean" flow areas with as few elbows and contractions as possible. As well, it was shown that the flow area of the venting system downstream of the furnace/water heater connection should also be as clean as possible. Field and monitoring results were used to suggest how well various current practices in vent connector installation serve the above design objectives. It was found that configurations in which the water heater vent connector is connected separately to the flue (i.e. it does not connect to the furnace vent connector) should be the least prone to combustion venting problems. 3 refs., 17 figs., 2 tabs.

4230 Marine Engineering

Refer also to citation(s) 36660, 36661

4240 Pollution Control Equipment

Refer also to citation(s) 35964, 35965, 35966, 35967, 36349, 37193

4250 Power Cycles

Refer also to citation(s) 35930

43 PARTICLE ACCELERATORS

Refer also to citation(s) 37494, 37640

37026 **Physics of particle accelerators: Volume 1.** AIP (Am. Inst. Phys.) Conf. Proc., No. 184. Month, M.; Dienes, M. (eds.). 1136p. American Institute of Physics, New York, NY (1989). Sponsored by DOE/ER;OUS. (CONF-8808234–Vol.1-Exc.: U.S. Particle Accelerator School: physics of particle accelerators; U.S. Particle Accelerator School, Batavia, Illinois, USA; Ithaca, New York, USA, 20 Jul - 14 aug 1987; aug 1988).

This book contains papers on the following topics: an introduction to the physics of particle accelerators; transverse motion of single particles in accelerators; fundamentals-longitudinal motion; rf system considerations for a large hadron collider; beam observation and the nature of instabilities; bunched beam diagnostics; fields, impedances, and structures; introduction to wake fields and wake potentials; characteristics of synchrotron radiation; review of linear collider beam-beam interaction; the linear collider beam-beam problem; a quantum treatment of beamstrahlung and its application to ribbon pulses; methods of beam optics; nonlinear dynamics; phase space concepts; comments on nonlinear dynamics studies in storage rings; the description of particle accelerators using high-order perturbation theory on maps; methods of stability analysis in nonlinear mechanics; advanced nonlinear theory: long-term stability at the SSC; a review on the lattice design of large hadron colliders; the physics of codes; and canonical integrators as tracking codes.

37027 **Physics of particle accelerators: Volume 2.** AIP (Am. Inst. Phys.) Conf. Proc., No. 184. Month, M.; Dienes, M. (eds.). 1197p. American Institute of Physics, New York, NY (1989). Sponsored by DOE/ER;OUS. (CONF-8808234–Vol.2-Exc.: U.S. Particle Accelerator School: physics of particle accelerators; U.S. Particle Accelerator School, Batavia, Illinois, USA; Ithaca, New York, USA, 20 Jul - 14 aug 1987; aug 1988).

This volume is based on lectures presented at the 1987 US Particle Accelerator School, held at Fermi National Accelerator Laboratory in July and August 1987, in addition to selected material from the school at Cornell University in August 1988. As is our custom, review articles are also included for completeness and to enhance the book's quality. In addition to topics on the Fermilab tevatron the following are discussed: a compendium of computer codes used in particle accelerator design and analysis; superconducting magnet system; superconductor developments; radio-frequency acceleration; principles and technology of RFQs; photocathode RF guns; low emittance thermionic electron guns; intense, low emittance injectors for RF electron linacs; final focus systems for linear colliders; positrons for linear colliders; free-electron lasers; free-electron lasers; fundamentals on intense relativistic electron beams; application of pulse power technology to ultra high energy electron accelerators; coherence and statistical properties of photon beams with application to the free-electron laser; and plasma acceleration of particle beams.

37028 (DOE/ER/03130–48C) **Offline computing farms.** Cutts, D.; Hoftun, J.; Partridge, R. Brown Univ., Providence, RI (USA). 26 Jan 1989. 4p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER03130. Order Number DE89013958/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The DØ experiment will require substantial offline computing resources to perform production analysis, data reduction, and Monte Carlo event generation. Given the significant head start obtained by CDF, it is imperative that DØ have a fully functional offline computing environment ready at detector turn on to allow fast hardware and software shakedown and quick analysis of the data. The ability to get physics results out quickly is especially important to the graduate students, postdocs, and junior faculty who need to be able to present physics talks for future jobs/tenure. For these reasons, we believe DØ must begin planning its offline computing environment now, paying particular attention to the issue of software compatibility which has plagued CDF. In particular, proper evaluation of system cost should give at least equal weight to software development, management, and operational demands on the collaboration. We believe the best solution to the DØ offline computing needs is the development of computing farms utilizing DEC VAX computers.

This note describes a model for such farms that we think can be realized with today's technology.

37029 QA at Fermilab. Bodnarczuk, M. (Fermi National Accelerator Lab., Box 500 Batavia, IL (US)). *Nuclear Materials Management. Annual Meeting Proceedings (USA)*, 17: 413-416 (1988). (CONF-880631–: 29. annual meeting of the Institute of Nuclear Materials Management, Las Vegas, NV, USA, 26-29 Jun 1988).

This paper opens with a brief overview of the purpose of Fermilab and historical synopsis of the development and current status of quality assurance (QA) at the Laboratory. The paper subsequently addresses some of the more important aspects of interpreting the national standard ANSI/ASME NQA-1 in pure research environments like Fermilab. Highlights of this discussion include, (1) what is hermeneutics and why are hermeneutical considerations relevant for QA, (2) a critical analysis of NQA-1 focussing on teleological aspects of the standard, (3) a description of the hermeneutical approach to NQA-1 used at Fermilab which attempts to capture the true intents of the document without violating the deeply ingrained traditions of quality standards and peer review that have been foundational to the overall success of the paradigms of high-energy physics.

4301 Design, Development, and Operation

Refer also to citation(s) 36649, 36908, 36912, 36964, 37566, 37567, 37568, 37569

37030 (BNL–42333) **Synchrotron light source data book.** Murphy, J. Brookhaven National Lab., Upton, NY (USA). Jan 1989. 96p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE89014499/JAW. Available from NTIS, PC A05/MF A01 - OSTI.

The "Synchrotron Light Source Data Book" is as its name implies a collection of data on existing and planned synchrotron light sources. The intention was to provide a compendium of tools for the design of electron storage rings as synchrotron radiation sources. The slant is toward the accelerator physicist as other booklets such as the X-ray Data Booklet, edited by D. Vaughan (LBL PUB-490), address the 'use' of synchrotron radiation. It is hoped that the booklet serves as a pocket sized reference to facilitate back of the envelope type calculations. It contains some useful formulae in 'practical units' and a brief description of many of the existing and planned light source lattices.

37031 (DOE/ER/40150–79) **CEBAF/SURA 1984 summer workshop: Proceedings.** Gross, F.; Whitney, R.R. (eds.). Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility. Nov 1984. 518p. Sponsored by DOE Energy Research. DOE Contract AC05-84ER40150. (CONF-8406162–: CEBAF summer workshop, Newport News, VA, USA, 25-29 Jun 1984). Order Number DE89014424/JAW. Available from NTIS, PC A23/MF A01 - OSTI (37.00); GPO Dep.

This report discusses the following topics: Summary: Magnetic Spectrometer Working Group; Workshop Report: Internal Targets and Tagged Photons; Nucleon Physics with Chromodynamics: From High Q^2 to Baryon Spectroscopy to Nuclear Physics; Quark Signatures in Nuclear Physics; What Can We Learn About the Three-Nucleon Wave Functions from High Energy Electrons; Coincidence and Polarization Measurements with High-Energy Electrons; NPAS – a Program of Nuclear Physics at SLAC; Spectrometers; Polarized Gas Targets in Electron Rings; Photonuclear Experiments Using Large Acceptance Detectors; 4 π Detectors; Magnetic Spectrometer Working Group Report; Workshop Report: Tagged Photons - Low Current Electron Beams and Large Acceptance - 4 π Detectors; Positron Beams at CEBAF; Lampshade Magnet for a Large-Aperture Detector; Meson Exchange in Relativistic Quark Models; Electron Scattering from Discrete Low-Lying Levels of ^{13}C at High Momentum Transfer; NN Potential With a Six Quark Core from the Constituent Quark Model; A Study of (e,e'N) Reactions from Nuclear Targets; Study of Complex Nuclei Using Internal Targets at CEBAF; The Kaon-Nucleon Interaction in a Quark Potential Model; and Current Conservation and Magnetic Form Factors of ^3He, ^3H.

37032 (DOE/ER/40150–80) **Research program at CEBAF (II): Report of the 1986 summer Study Group, June 2–August 29, 1986.** Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility. Jan 1987. 725p. Sponsored by DOE Energy Research. DOE Contract AC05-84ER40150. Order Number DE89014428/JAW. Available from NTIS, PC A99/MF A01 - OSTI (47.50).

This report discusses research performed at the CEBAF accelerator. Topics covered are: single nucleon emission; excited baryons; electromagnetic production of strange nuclear systems; studies in the x-scaling region; weak interactions; particle theory; magnetic spectrometers; real photons; and targets and production processes. (LSP)

37033 (DOE/ER/40355–T1) **Siting the superconducting super collider.** Price, R.; Rooney, R.C. (eds.). National Academy of Sciences - National Academy of Engineering, Washington, DC (USA). Super Collider Site Evaluation Committee. 1988. 62p. Sponsored by DOE Energy Research. DOE Contract AC01-87ER40355. Order Number DE89014528/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

At the request of the Department of Energy, the National Academy of Sciences and the National Academy of Engineering established the Super Collider Site Evaluation Committee to evaluate the suitability of proposed sites for the Superconducting Super Collider. Thirty-six proposals were examined by the committee. Using the set of criteria announced by DOE in its Invitation for Site Proposals, the committee identified eight sites that merited inclusion on a "best qualified list." The list represents the best collective judgment of 21 individuals, carefully chosen for their expertise and impartiality, after a detailed assessment of the proposals using 19 technical subcriteria and DOE's life cycle cost estimates. The sites, in alphabetical order, are: Arizona/Maricopa; Colorado; Illinois; Michigan/Stockbridge; New York/Rochester; North Carolina; Tennessee; and Texas/Dallas-Fort Worth. The evaluation of these sites and the Superconducting Super Collider are discussed in this book.

37034 (DOE/ER/40374–21) **A compact x-ray lithography lattice using superferric magnets.** Swenson, C.A.; Huson, F.R.; MacKay, W.W.; Chen, L.K.; Ohnuma, S. Texas Accelerator Center, The Woodlands, TX (USA). 1989. 3p. Sponsored by DOE Energy Research. DOE Contract FG05-87ER40374. (CONF-890335–217: 13. particle accelerator conference, Chicago, IL, USA, 20-23 Mar 1989). Order Number DE89013947/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A conceptual lattice design for a very compact superconducting synchrotron dedicated to x-ray lithography is presented. The synchrotron radiation produced in the high field superconducting magnets has a critical wavelength of 10Å at a beam energy of about 787 MeV. The size and angular divergence of the beam in this lattice can satisfy the future requirements for x-ray lithography: $\sigma_{x,y} \leq$ 1mm, and $\sigma l_{x,y} \leq$ 1mr. The paper will present an optimization of the lithography parameters σ_x, and σl_x for this lattice configuration. 7 refs., 4 figs., 1 tab.

37035 (DOE/ER/40374–22) **Compact linacs for positron emission tomography.** Raparia, D.; Machida, S. Houston Univ., TX (USA). 1989. 4p. Sponsored by DOE Energy Research. DOE Contract FG05-87ER40374. (CONF-890335–216: 13. particle accelerator conference, Chicago, IL, USA, 20-23 Mar 1989). Order Number DE89013948/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Compact 14 MeV proton and 7 MeV deuteron linacs for use in positron emission tomography (PET) have been studied, and conceptual designs for low energy beam transports (LEBT), radio-frequency quadrupole (RFQ) and drift tube linacs (DTL) have been achieved. The machines are compact and simple enough to be operated in hospitals. The LEBT consist of two Einzel lenses and are about 25 cm long. The 425 MHz proton RFQ is designed for 50 mA peak current, and the 425 MHz deuteron RFQ is designed for 25 mA peak current. Both 850 MHz DTLs use permanent quadrupole magnets and have high acceleration field of 15 MV/m with a peak field of twice the Kilpatrick limit. 6 refs., 5 figs., 2 tabs.

37036 (INIS-SU–87/A, pp. 3-5) **Acceleration He_4^{2+} ions on the 1-2 proton linear accelerator up to the energy of 24 MeV/**

nucleus. Artemov, V.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki); Batalin, V.A.; Kapchinskij, I.M. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

First results of He_4^{2+} ion acceleration on the 1-2 strong focusing proton linear accelerator are considered. Use of additional accelerating structure with asymmetric alternating phase focusing, He_4^{2+} ion charge exchange and further acceleration of He_4^{2+} ions in linear accelerator second resonator are substantiated. 4 refs.; 3 figs.

37037 (INIS-SU–87/A, pp. 8-10) **Reconstruction project for accelerating structure of small-size deuteron linear accelerator.** Belej, A.S. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.); Gusev, E.V.; Derepovskij, V.N.; Kaplin, S.S.; Krivulya, S.Yu.; Shestopal, S.A.; Shulika, N.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Reconstruction project for small-size deuteron linear accelerator with alternating-phase focusing is discussed. Reconstruction is carried out mainly by substitution of modified structure for the accelerated one. In a new structure the lengths of separate accelerating-focusing periods are reduced, that permitted to take four such periods rather than three, the length being unchanged. HF field operating intensity on the system axis has increased up to 12 kV/cm. Numerical calculation of particle dynamics and modelling of structure electrodynamic characteristics permit to expect the increase of accelerated beam intensity. 2 refs.; 5 figs.

37038 (INIS-SU–87/A, pp. 46-48) **1 MeV proton accelerator.** Val'dner, O.A. (Moskovskij Inzhenerno-Fizicheskij Inst., Moscow (USSR)); Gass, V.F.; Glazkov, A.A. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Study of ion linear accelerators aimed at their widescale utilization in commercial practice is carried out in Moscow Engineering Physical Institute. 1 MeV proton linear accelerator is the first one to satisfy this purpose. Basic moments of accelerator design and construction are considered. In detailing, designing and producing separate accelerator units weel-known designs but with a new elements, as well as new, promising engineering ideas were widely used. The accelerator tuning was carried out for a maximum of accelerated current. The obtained accelerator performances well agree with the calculated data. The accelerated proton peak current is 4 mA, the average current is limited by injected beam parameters and consitutes 6 μA. 4 refs.; 5 figs.

37039 (INIS-SU–87/A, pp. 49-52) **Software for the communication of the BESM-6 computer complex with peripheral centers.** Borisov, A.D. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.); Dem'yanov, V.G.; Luk'yanova, V.P.; Mandryk, A.N.; Panchenko, V.I.; Pronzhenko, N.M.; Slabospitskij, R.P.; Shulika, A.K.; Shcherbak, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Hardware and software structure aimed at the communication of the BESM-6 computer complex with peripheral data acquisition and processing systems are described. Communication hierarchy includes data processor (two BESM-6 computers), communication processor Mera-60 and peripheral computer complexes for physical experiment data processing automation. The message formats are determined. The line speed in external communication is 16 kbaud, in Mera-60-BESM-6 channel swapping rate constitutes 6.5...8.6 kbyte/s and depends on computer loading. 11 refs.; 3 figs.

37040 (LA–11601-MS) **Proton linear accelerators: A theoretical and historical introduction.** Lapostolle, P.M. Los Alamos National Lab., NM (USA). Jul 1989. 129p. DOE Contract W-7405-ENG-36. Order Number DE89014261/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

From the beginning, the development of linear accelerators has followed a number of different directions. This report surveys the basic ideas and general principles of such machines, pointing out the problems that have led to the various improvements, with the hope that it may also aid further progress. After a brief historical survey, the principal aspects of accelerator theory are covered in some detail: phase stability, focusing, radio-frequency accelerating structures, the detailed calculation of particle dynamics, and space-charge effects at high intensities. These developments apply essentially to proton and ion accelerators, and only the last chapter deals with a few aspects relative to electrons. 134 refs.

37041 (LA-UR–89-1901) **Cost of a normalconducting linac structure.** Schaffer, G. Los Alamos National Lab., NM (USA). 1989. 4p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890299–14: AHF accelerator design workshop, Los Alamos, New Mexico, USA, 20-25 Feb 1989). Order Number DE89014237/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We would like to illustrate the cost variation for different gradients of a possible LAMPF linac extension, assuming a normalconducting structure.

37042 (LA-UR–89-1903) **Cost projection for a superconducting linac structure.** Schaffer, G. Los Alamos National Lab., NM (USA). 1989. 14p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890299–12: AHF accelerator design workshop, Los Alamos, New Mexico, USA, 20-25 Feb 1989). Order Number DE89014029/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The increase of energy of the present 800 MeV proton linac at LAMPF to 1.6 to 2.2 GeV is of primary importance for the proposed future experimental program of this Laboratory. Layout and cost studies have been performed for (a) normalconducting and (b) superconducting accelerating structures. A more recent cost analysis for a superconducting structure is given in this report. 4 figs., 2 tabs.

37043 (LA-UR–89-1956) **Summary of Linac Group discussions.** Schaffer, G. Los Alamos National Lab., NM (USA). 1989. 6p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890299–13: AHF accelerator design workshop, Los Alamos, New Mexico, USA, 20-25 Feb 1989). Order Number DE89014257/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper discusses upgrading of the LAMPF I linac. Particular topics discussed are: sources of and cures for linac beam halos, ion source, RFQ, chopper and drift-tube linac, cavity-coupled linac, superconducting linac structure, new rf power sources, EHF linac design, and cost projections. (LSP)

37044 (ORNL/FTR–3250) **[Twelfth international conference on cyclotrons and their applications, Berlin, W. Germany, and**

visit to Hahn-Meitner-Institute, May 8–12, 1989]: Foreign trip report. Olsen, D.K.; Mosko, S.W. Oak Ridge National Lab., TN (USA). 12 Jun 1989. 10p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014729/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The travelers attended the "Twelfth International Conference on Cyclotrons and Their Applications" held in Berlin, West Germany, from May 8–12, 1989, where they presented a paper on "HISTRAP Hardware Prototype Studies." One traveler served on the International Organizing Committee (D.K. Olsen). The conference offered a unique opportunity to learn of cyclotron and related activity throughout the world. Review talks were given on the current generation of $K \geq 400$ superconducting and conventional separated-sector research cyclotrons. All of these machines are in operation or nearing completion. No new major projects were announced. There is considerable new work on cyclotrons for radiation therapy and isotope production.

37045 (SAND–89-0863C) **A technique for efficiently cleaning and conditioning low- and medium-energy accelerators.** Langley, R.A.; McDonald, J.M. Sandia National Labs., Albuquerque, NM (USA). 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC04-76DP00789. (CONF-8904230–2: AVS topical conference on surface conditioning of vacuum systems, Los Angeles, California, USA, 3-7 Apr 1989). Order Number DE89013450/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A technique has been developed for cleaning and conditioning low- and medium-energy accelerators by alternating a glow discharge using hydrogen gas and a glow discharge using oxygen gas. The study was initiated using a 2.5-MeV Van de Graaff accelerator. It has since been used on both lower-energy (down to 10 keV) and higher-energy (up to 10 MeV) accelerators with equal effectiveness. In the development stage, the conditioning time for attaining the nominal maximum voltage was reduced from about ten days using pumping and voltage conditioning to one day using the glow discharge technique. After a glow discharge conditioning sequence, the 2.5-MeV accelerator could be operated effectively at energies to 3.4 MeV. In addition, the accelerator tube life was found to increase significantly over the expected lifetime. This technique is described and safety considerations are discussed.

37046 (UCRL–100356) **Modeling of the proposed ATA fast correction coils.** Zentler, J.M.; Vogtlin, G.E.; Thomas, R.A. Lawrence Livermore National Lab., CA (USA). Jun 1989. 5p. Sponsored by DOD;DOE/DP. DOE Contract W-7405-ENG-48. (CONF-890665–26: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, CA, USA, 12-14 Jun 1989). Order Number DE89014037/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

The Fast Correction Coil system will provide dynamic beam steering on the ATA linear electron accelerator at LLNL. We are designing the system using multi-conductor transmission line theory to model the coil response. The JASON electrostatics code is used to predict both E and B field profiles within the coil and to determine all coil electrical parameters. We simulate the electrical system behavior using either of two circuit models based on these parameters. One incorporates the NET2 circuit analysis code, while the other is a purely analytic model. These models have allowed us to conduct a comprehensive trade-off study aimed at designing the most efficient system within the constraints set by accelerator physics requirements. 3 refs., 9 figs.

4302 Beam Dynamics, Field Calculations, and Ion Optics

Refer also to citation(s) 36911, 36913, 36920, 36921, 37037, 37040, 37095

37047 (DOE/ER/40374–17) **Comparison of analytical and computational estimates of reduction in linear aperture in the presence of sextupole field.** Li, Mingyang; Ohnuma, S. Texas Univ., Houston, TX (USA). Dept. of Physics. 1989. 3p. Sponsored by DOE Energy Research. DOE Contract FG05-87ER40374. (CONF-890335–221: 13. particle accelerator conference, Chicago, IL, USA, 20-23 Mar 1989). Order Number DE89013943/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

For an easy comparison of the expected improvement in the linear aperture when magnets are sorted according to various schemes, it is desirable to have a figure-of-merit which can be evaluated without time-consuming tracking calculations. Such a figure-of-merit is proposed here in terms of the sextupole distortion functions introduced by T. Collins. A test lattice composed of 512 dipoles with random sextupole field component is used to calculate the figure-of-merit and the indicated improvement in the linear aperture is compared with the results from numerical tracking. As the linear aperture, two definitions are used, one by the SSC-CDG (smear = 6.4%) and the other by CERN SPS (smear = 1.75%). 8 refs., 2 tabs.

37048 (DOE/ER/40374–18) **The beam tracking during the first few milliseconds of a low energy booster.** Machida, Shinji. Texas Accelerator Center, The Woodlands, TX (USA). 28 Jun 1989. 4p. Sponsored by DOE Energy Research. DOE Contract FG05-87ER40374. (CONF-890335–220: 13. particle accelerator conference, Chicago, IL, USA, 20-23 Mar 1989). Order Number DE89013944/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The space charge effect in the presence of sextupole resonance was studied using the lattice of the SSC low energy booster. We performed the multiparticle tracking with a self-consistent charge distribution. When there are synchrotron oscillations, a slight emittance growth is observed, which differs from the result of non-self-consistent tracking. However, this growth cannot be caused by repeated crossing of resonances due to sextupole field in dipoles. The tracking result has shown that the emittance dilution of the whole beam should be considered instead of amplitude growth of some particular particles. 9 refs., 4 figs., 3 tabs.

37049 (DOE/ER/40374–20) **Application of novel material in crystal accelerator concepts.** Newberger, B.; Tajima, T.; Huson, F.R.; Mackay, W.; Covington, B.C.; Payne, J.R.; Zou, Z.G.; Hahale, N.K.; Ohnuma, S. Texas Univ., Houston, TX (USA). 1989. 3p. Sponsored by DOE Energy Research. DOE Contract FG05-87ER40374. (CONF-890335–218: 13. particle accelerator conference, Chicago, IL, USA, 20-23 Mar 1989). Order Number DE89013946/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Materials which incorporate regular macroscopic features superposed on the underlying crystal lattice are of potential interest in the application to crystal accelerators and coherent radiation sources. We have recently begun an investigation of one such material, porous Si, in which pores of radii up to a few tens of lattice spacings are etched through finite volumes of a single crystal. The potential reduction of losses to particles hyperchanneled along the pores makes this a very interesting material in crystal accelerators for relativistic, positively charged particles. Our results on material properties which are important in this context will be presented. The consequences for particle transport will be discussed. 12 refs., 8 figs.

37050 (DOE/ER/40374–23) **Beam-beam interaction and pacman effects in the SSC with random nonlinear multipoles.** Goderre, G.P.; Mahale, N.K.; Ohnuma, S. Houston Univ., TX (USA). 25 May 1989. 9p. Sponsored by DOE Energy Research. DOE Contract FG05-87ER40374. (CONF-890594–1: 3. advanced inertial confinement fusion accelerator beam dynamics workshop: beam-beam effects in circular colliders, Novosibirsk, USSR, 20 May - 3 jun 1989). Order Number DE89013949/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In order to find the combined effects of beam-beam interaction (head-on and long-range) and random nonlinear multipoles in dipole magnets, transverse tunes and smears have been calculated as a function of oscillation amplitudes. Two types of particles, "regular" and "pacman," have been investigated using a modified version of the tracking code TEAPOT. Regular particles experience beam-beam interactions in all four interaction regions (IR's), both head-on and long-range, while pacman particles interact with bunches of the other beam in one medium-beta and one low-beta IR's only. The model for the beam-beam interaction is of weak-strong type and the strong beam is assumed to have a round Gaussian charge distribution. Furthermore, it is assumed that the vertical closed orbit

deviation arising from the finite crossing angle of 70 μrad is perfectly compensated for regular particles. The same compensation applied to pacman particles creates a closed orbit distortion. Linear tunes are adjusted for regular particles to the design values but there are no nonlinear corrections except for chromaticity correcting sextupoles in two families. Results obtained in this study do not show any reduction of dynamic or linear apertures for pacman particles when the oscillation amplitude is less than $\sim 10\sigma$. However, smears often exhibit a strong dependence on tunes, casting some doubts on the validity of defining the linear aperture from the smear alone. 10 refs., 16 figs., 3 tabs.

37051 (FNAL/C–89/115) **Gabor lens focusing of a negative ion beam.** Palkovic, J.A.; Mills, F.E.; Schmidt, C.; Young, D.E. Fermi National Accelerator Lab., Batavia, IL (USA). May 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-890335–212: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89014170/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Gabor or plasma lenses have previously been used to focus intense beams of positive ions at energies from 10 keV to 5 MeV. It is the large electrostatic field of the non-neutral plasma in the Gabor lens which is responsible for the focusing. Focusing an ion beam with a given sign of charge in a Gabor lens requires a non-neutral plasma with the opposite sign of charge as the beam. A Gabor lens constructed at Fermilab has been used to focus a 30 keV proton beam with good optical quality. We discuss studies of the action of a Gabor lens on a beam of negative ions. A Gabor lens has been considered for matching an H^- beam into an RFQ in the redesign of the low energy section of the Fermilab linac. 9 refs., 3 figs., 1 tab.

37052 (GANIL-T–89-01) **Theoretical and numerical study of cyclotron in space charge conditions.** Cazoll, V. Paris-11 Univ., 91 - Orsay (France); Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). Nov 1988. 95p. (In French). Order Number DE89789212/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

During the last decade, the need of high ion beam intensities urged the cyclotron laboratories to amplify the efforts to study the space charge effects in these machines. The cyclotron space charge effects are intimately linked to two specific features of this kind of accelerator; - the beam is formed of a succession of bunches having about the same size for transverse and longitudinal dimensions, - the radial and longitudinal motions are strongly coupled. The analytical model developed in this thesis explains some effects produced by the space charge forces. It describes the motion of an ion contained in a bunch. This ion moves under the effects of the guiding field forces, the accelerator cyclotron field forces and the space charge forces created by the other particles of the bunch. The solutions of the first order differential equations describe the small motion around one particle, which is taken as a reference particle. These solutions are valid in the vicinity of the bunch center, where the space charge forces are considered linear. The results of the model are compared with those obtained from a multiparticle code. This code has been already used successfully at GANIL (the Great National Heavy Ions Accelerator). The evolution of the whole beam has also been studied with this code, which takes into acount the non linear space charge effects and all the couplings. The results obtained by the numerical study of a proposed new injector for the cyclotrons of GANIL shows that it is possible to obtain an important increase of the beam intensity.

37053 (IFVE-OLU–88-32) **Quasistatic model of H-wave accelerating structures.** Barsukov, A.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij. 1988. 10p. (In Russian). Order Number DE89620108/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Submitted to the journal Zh. Tekh. Fiz.

A quasistatic model of the long H-wave cavities used to construct the linear ion accelerating structures is described. The model is based on the private regions method using the extension basis and equivalence quasistatic boundary conditions on the accelerating beam channel. This approach allows one to derive the approximate dispersion equation for the fundamental H-oscillation frequencies as well as to take into account the influence of the regional effects in the border regions on the H-structure parameters. 9 refs.; 4 figs.; 1 tab.

37054 (IFVE-OLU–88-33) **Correction of field distribution in an H-wave weakly irregular accelerating structure.** Barsukov, A.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij. 1988. 10p. (In Russian). Order Number DE89620109/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The problem of calculating the characteristics of the cross-section of the weakly irregular accelerating structure on the final length H-wave is considered. The dependence of the accelerating electrodes geometry on the relative speed of an equilibrium particle is taken into account. The problem is solved by the perturbation theory method for a quasistatic model of the H-structures minimizing RMS field distribution deflexion from the regular one. The calculational example for the accelerating structure on the cylinder H-resonator of the linear ion accelerator with high frequency quadrupole focusing of the IHEP injector- to-booster is considered. 11 refs.; 2 figs.; 2 tabs.

37055 (INIS-SU–87/A, pp. 14-23) **Effect of high-frequency energy recuperation on the intense electron beam acceleration dynamics.** Ajzatskij, N.I. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Results of theoretical and experimental investigations of intense electron beam acceleration dynamics in linear resonance accelerators with feedbacks providing for high-frequency energy recuperation are presented. It is shown that at defined accelerated current values and feedback parameters automodulation acceleration, characterized by high beam parameter modulation both at operating frequency of accelerator and at a lower one, defined by accelerating system electrodynamic characteristics may be carried out. 24 refs.; 8 figs.

37056 (INIS-SU–87/A, pp. 24-26) **On the matching of accelerating channel of ion linear accelerator at high currents.** Bondarev, B.I. (AN SSSR, Moscow (USSR). Inst. Yadernykh Issledovanij); Kabanov, V.S.; Pashen'kov, A.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Longitudinal motion matching when the beam passes from the long-wave to short-wave accelerator region is considered. The beam matching is shown to take place in a special device both at high and low beam currents. To satisfy optimum matching the matching device length must be increased with the current growth and electric field intensity and synchronous phase must be increased or decreased depending on the ratio of Coulomb parameters in the long-wave and short-wave accelerator regions and frequencies of longitudinal phase oscillations. Nonoptimality of matching parameters cause growth of efficient longitudinal emittance with δ gain in short-wave accelerator region. δ value increases with the beam current growth. To estimate optimum matching parameters depending on the beam current the ratios are presented. 2 refs.; 2 figs.; 1 tab.

37057 (INIS-SU–87/A, pp. 27-29) **Numerical simulation of plasma-filled diode gap with magnetic insulation.** Kiyashko, V.A. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.); Kornilov, E.A.; Loginov, L.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR).

Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Cleaning of magnetized diode gap from plasma ions followed by electron space charge formation in a plasma is investigated. It is shown that as a result of time redistribution of electron and ion concentration along the gap length the electric field in plasma may be several fold greater the vacuum field, that causes the corresponding increase of external insulating magnetic field in comparison with the critical cut-off field. The gap cleaning takes place for a period compared with the transit time of ions of anode-cathode space. 6 refs.; 3 figs.

37058 (INIS-SU–87/A, pp. 30-32) **Electromagnetic wave scattering on the jump of the waveguide cross section.** Ostroushko, V.N. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Electromagnetic wave scattering on the jump of the waveguide cross section and eigenvalue problem for the section of this structure are considered. The ratios expressing travelling and beyond-cutoff wave amplitudes in terms of some functions assigned for the intermediate cross section are desired. The problem solutions are accurate for the structures distinguished by intermediate cross section currents. The derived approximate solutions are found taking into account requirements for minimization of the power dissipated, by these currents, the electromagnetic wave power in the structure being specified. This method is checked by comparing the calculated and reference data for coaxial resonator. 2 refs.; 1 fig.

37059 (INIS-SU–87/A, pp. 40-43) **Application of cyclotron instability for excitation of RF fields in linear accelerators.** Ivanov, B.I. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.); Onishchenko, I.N.; Balakirev, V.A.; Gorozhanin, D.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Application of fast electron beams (EB) for RF-field excitation in slow-down structures (SDS) of linear ion accelerators using normal and anomalous Doppler effect cyclotron instability is considered. To realize this method the EB is injected along the SDS AXIS. Longitudinal resonance magnetic field varying along the length depending on the wave phase velocity is induced. The main advantages are the following: provision for simultaneous radial and phase stability of accelerated ions, one-mode excited oscillations, resonance excitation of RF fields with a beam not changing the wave frequency of phase velocity in SDS. A detailed consideration is carried out on the example of H-wave accelerating structures. Necessary calculations are performed promising character and advantages of the given method of RF-field excitation and ion acceleration are shown. 11 refs.

37060 (INIS-SU–87/A, pp. 64-67) **Optimization of particle dynamics in accelerating installation with account of the excitation of resonator by a beam.** Vladimirova, L.V. (Leningradskij Gosudarstvennyj Univ., Leningrad (USSR)); Ovsyannikov, D.A.; Rubtsova, I.D.; Durkin, A.P.; Shlygin, O.Yu.; Svistunov, Yu.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Numerical methods of optimization of particle dynamics in an accelerator, based on integral functionals taking into account the travelling wave acceleration, are suggested. To find optimum injection energy and extremum control parameters gradient methods and random search algorithms are used. 9 refs.; 3 figs.

37061 (INIS-SU–87/A, pp. 68-69) **On the acceleration of relativistic electron beam over dielectrical grid.** Borovskij, I.V. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.); Zhilkov, S.V.; Khizhnyak, N.A.; Papkovich, V.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Efficiency of electron acceleration in the field of standing formed by beam of laser radiation over dielectrical grid is estimated. The accleration process is shown to be one-mode and with existing lasers and dielectric materials permits to obtain an average particle acceleration rate of the order of $2x10^4$ eV/λ. 3 refs.; 2 figs.

37062 (JINR-R–9-88-416) **Hardware and software complex for cyclotron beam dynamics simulation.** Vorozhtsov, S.B.; Kalinkina, M.B.; Saenko, V.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1988. 12p. (In Russian). Order Number DE89620120/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The main part of the considered complex for cyclotron beam dynamics simulation is the system of programs provided by courtesy of A. Chabert (GANIL), and also the programs written at the Laboratory of Nuclear Problems, JINR. For th beam dynamics simulation the Pravets-16 personal computer connected to CDC-6500 host computer through JINET local net is used. Implementation of this system allowed one to carry out the calculations of equilibrium orbit, betatron frequencies, isochronous field under the given flutter, central beam orbit, the beam transition from injection to extraction radii with space charge effects included. 13 refs.; 10 figs.; 1 tab.

37063 (LA-UR–89-2089) **Unbunched beam electron-proton instability in the PSR and advanced hadron facilities.** Wang, Tai-Sen; Pisent, A.; Neuffer, D.V. Los Alamos National Lab., NM (USA). 1989. 16p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890299–11: AHF accelerator design workshop, Los Alamos, NM, USA, 20-25 Feb 1989). Order Number DE89014235/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We studied the possibility of the occurrence of transverse instability induced by trapped electrons in unbunched beams in the Proton Storage Ring and the proposed Advance Hadron Facility (AHF) at Los Alamos, as well as in the proposed Kaon Factory at TRIUMF. We found that the e-p instability may be possible for unbunched beams in the PSR but is unlikely to occur in the advanced hadron facilities. 8 refs., 4 figs.

37064 (LBL–27189) **General properties of an asymmetric B-factory lattice.** Autin, B. Lawrence Berkeley Lab., CA (USA). Apr 1989. 6p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8904227–1: Workshop on high luminosity asymmetric storage rings for AB-physics, Pasadena, California, USA, 25-28 Apr 1989). Order Number DE89012996/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Scaling laws consistent with general rules of optimization have been established for colliders of unequal beams. They are valid for any ring deduced from the circular shape by insertion of straight sections. The constraint on the synchrotron motion seems to be met more easily for the head on configuration than for a finite crossing angle. In any case, the equal damping decrement requirement leads to the use of high field dipoles in the low energy ring. If the rules on equal beam size and equal beam-beam tune shift are generally accepted, those on equal damping decrements and equal amplitude of the betatron phase modulation by the synchrotron motion are still controversial matters: below a certain threshold which is still undefined, they may be unimportant. Finally, additional flexibility could be provided by wigglers and radio frequency adjustments. 5 refs.

37065 (SLAC-PUB–4882) **Applications of a plasma lens with bootstrap disruption.** Rajagopalan, S.; Chen, P.; Rosenzweig, J. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515;W-31109-ENG-38. (CONF-890335–203: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89013746/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this work, we examine the viability of employing the mechanism of "bootstrap disruption" with an underdense plasma lens to enhance the luminosity in linear colliders. We discuss the optics of an underdense plasma lens for electrons and positrons. We present results of such a scheme for the SLC, and hetero-energetic B-factory designs. 11 refs., 4 figs., 2 tabs.

37066 (SLAC-PUB–4928) **PHASEFIX: Correcting the tunes of the SLC Arcs.** Haiessinski, J.; Bambade, P.; Brown, K.L.; Burke, D.L.; Fieguth, T.H.; Hutton, A.; Mattison, T.; Murray, J.J.; Phinney, N.; Placidi, M. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Apr 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–204: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89013752/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The betatron phase advance in the SLC ARC beam transport line is sensitive to gradient errors in the magnetic lattice. The systematic errors in the phase advance, combined with the rolls required to follow the terrain, can lead to xy-coupling which significantly distorts the betatron phase-space. The technique used to measure and correct the tune of the Arcs is reported. 9 refs., 7 figs.

4303 Auxiliaries and Components

Refer also to citation(s) 36896, 36911, 36920, 36921, 36922, 36923, 36925, 36933, 36934, 36942, 36943, 36946, 36963, 37004, 37005, 37007, 37013, 37107, 37480, 37774, 37775, 37780, 37781

37067 (AD-A–204929/4/XAB) **Novel methods of acceleration. Final report, 30 September 1983-29 September 1988.** Nation, J.A. Cornell Univ., Ithaca, NY (USA). 29 Sep 1988. 19p. Available from NTIS, PC A03/MF A01.

A full-cusp diode geometry and fast-puff valve system were developed for the proton linac experiment. After passing through the first gap section, a transport efficiency of 99% was achieved. Microwave-input mode stability was tested on a rectangular cross section undulating guide accelerator cavity. Switching to a circular cross section would appear to have certain advantages.

37068 (BNL–52169) **Beam position monitor analysis.** Di Massa, G.; Ruggiero, A.G. Brookhaven National Lab., Upton, NY (USA). Mar 1989. 21p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE89014582/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A large proportion of devices used to interact with charged-particle beams in accelerator or storage rings can be classified as pick-ups or kickers. These devices extract information about the particle motion or affect a change in the motion. One device used frequently as pick-up or kicker is made with two little plates with one or more terminations per plate. In this paper the structure with one termination per plate is examined. The azimuthal dependence is taken into account in circular geometry for one plate of given dimensions. The charges and currents induced on the plates are studied using azimuthal and frequency harmonic expansions. The potential equations are derived and developed in the frequency domain in order to give the close expression of the output voltage. And finally, the numerical results are discussed. 9 refs., 4 figs.

37069 (CONF-890335–209) **Superconducting low-velocity linac for the Argonne positive-ion injector.** Shepard, K.W.; Markovich, P.K.; Zinkann, G.P.; Clifft, B.; Benaroya, R. Argonne National Lab., IL (USA). 1989. 3p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, Illinois, USA; 20-23 Mar 1989. Order Number DE89014639/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A low-velocity superconducting linac has been developed as part of a positive-ion injector system, which is replacing a 9 MV tandem as the injector for the ATLAS accelerator. The linac consists of an independently phased array of resonators, and is designed to accelerate various ions over a velocity range $.008 < v/c < .06$. The resonator array is formed of four different types of superconducting interdigital structures. The linac is being constructed in three phases, each of which will cover the full velocity range. Successive phases will increase the total accelerating potential and permit heavier ions to be accelerated. Assembly of the first phase was completed in early 1989. In initial tests with beam, a five-resonator array provided approximately 3.5 MV of accelerating potential and operated without difficulty for several hundred hours. The second phase is scheduled for completion in late 1989, and will increase the accelerating potential to more than 8 MV. 5 refs., 2 figs., 1 tab.

37070 (CONF-890335–214) **The measurement of Twiss parameters using SFC's.** Rosing, M.; Hummer, C.; Zolecki, R. Argonne National Lab., IL (USA). 1989. 8p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, Illinois, USA; 20-23 Mar 1989. Order Number DE89013649/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Segmented Faraday Cup (SFC) consists of 48 copper plates that are 1 mm x 75 mm x 10 mm. These plates are stacked against each other on the 75 mm x 10 mm face with a layer of kapton between them for electrical insulation. When the assembly is viewed in the direction of the incident beam, the beam sees 48 vertical electrodes that are 1 mm x 75 mm and 10 mm thick. The copper plates and the kapton are held together in an aluminum frame which is mounted on a rotating shaft. This assembly can be placed in the beam by rotating the shaft. Another SFC of the same construction is also mounted on this shaft. This other SFC, however, has its plates mounted horizontally rather than vertically. Thus by rotating the shaft either the vertical SFC, the horizontal SFC, or a scintillator screen may be placed into the beam. In addition, the shaft can be rotated so that none of these elements are in the beam. The SFC's were used to measure the emittance of the beam by using a scanning slit. The theory and the method for this measurement are presented. A description of the electronics is presented. A sample of a beam profile and the results of an emittance measurement are presented. 2 refs., 5 figs.

37071 (CRN-VIV–60) **Beam transmission in MP equipment. New measurements. Main effects and application to VIVITRON.** Haas, F.; Muller, C.; Nadji, A.; Rebmeister, R. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. Jan 1989. 17p. (In French). Order Number DE89789270/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The MP equipment is presented and the vacuum values at different measuring points are indicated. The low energy transmission stage (foil and gas strippers) high energy stage (5, 10, and 15 micro-g/cm^2 foils and gas stripper) are described, as well as the global system. For the Vivitron, in order to reach equilibrium thickness, pression in the stripping channel should be higher than that in the MP channel, and pump power should be planned accordingly.

37072 (DOE/ER/40124–17) **Superconducting booster project: [Final report].** Storm, D.W. Washington Univ., Seattle, WA (USA). Nuclear Physics Lab. [1989]. 13p. Sponsored by DOE Energy Research. DOE Contract AC06-84ER40124. Order Number DE89014120/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The central objective of the superconducting booster project was to expand the existing accelerator facility by the addition of a superconducting linear accelerator. This linear accelerator is injected by the existing tandem electrostatic accelerator, and it is designed to increase the beam energy by a factor of about two for protons and by a factor up to four for heavier ions up to about mass 50. The accelerating elements are lead-plated quarter-wave resonators. This report discusses progress on this booster.

37073 (DOE/ER/40374–19) **An optimized H⁻ magnetron ion source/lebt system.** Tompkins, P.A.; Huson, F.R.; Raparia, D. Texas Accelerator Center, The Woodlands, TX (USA). 1989. 3p. Sponsored by DOE Energy Research. DOE Contract FG05-87ER40374. (CONF-890335–219: 13. particle accelerator conference, Chicago, IL, USA, 20-23 Mar 1989). Order Number DE89013945/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Availability and usefulness of accelerators is greatly dependent on machine efficiency. Research must focus on less expensive, more compact accelerators with brighter beams. To achieve this goal for H^- ion sources, TAC has optimized the present Brookhaven AGS source for use with their REQ program. The TAC source incorporates an extraction system with a circular aperture which provides an azimuthally symmetric beam. The complete system has been simplified including removal of the gradient bending magnet found in conventional sources of this type. This source will soon be combined with an electrostatic low energy beam transport. This will create a simpler and more compact H^- ion source and beam transport system than is presently available. 7 refs., 5 figs., 1 tab.

37074 (FNAL/C–89/126) **Automatic steering corrections to minimize injection oscillations in the Fermilab Antiproton Source rings.** Harding, D.J.; Riddiford, A.W. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-890335–213: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89014171/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Missteering of particle beam at injection into a circular accelerator produces coherent betatron oscillations. The beam position monitor system in the Antiproton Source at Fermilab can measure the beam position on each turn around the ring during these oscillations. From the amplitude and phase of the oscillations, corrections to the beamline steering are calculated to remove the oscillations. The analysis includes the case where the horizontal and vertical tunes are quite strongly coupled. This technique has proved to be valuable both in operation of the Fermilab Collider and as an analytical tool. 4 refs., 2 figs.

37075 (GANIL-T–89-02) **Heavy ions beam axial injection tudy in a compact cyclotron.** Chel, S. Paris-7 Univ., 75 (France); Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). Nov 1988. 112p. (In French). Order Number DE89789213/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

The aim of the OAE and OAI projects developed at GANIL is respectively to increase the "medium" heavy ion energies to get 45 MeV/A beams up to Xenon, and to increase the beam intensities. This study deals with the injection stage of the second of these operations. In this new design, the ECR source potential is 100 kV to avoid losses due to space charge. The inflector used for the injection in the cyclotron NC01 is a spiral type with two parameters. The equations of motion are straighforward to obtain and numerical simulation programs have been developed. It is then possible to compute the transfer matrix of this inflector and to study the behavior of the beam inside it. It is necessary to introduce an electrostatic quadrupole after the inflector exit to realize a good matching to the cyclotron with the condition of always staying inside the inflector acceptance. For these matching conditions, the inflector transmission is increased if one introduces a rotation of the inflector exit face. It is then possible to transfer beams with the required emittances and intensities in the OAI project. The knowledge of the inflector characteristics makes it possible to design an axial injection line to obtain a matched beam.

37076 (IFVE-OMVT–88-53) **Some mathematical aspects of creation of the control system for a physical installation. Analytical review.** Efimov, K.M.; Efimova, T.E.; Zagurskij, A.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij. 1988. 23p. (In Russian). Order Number DE89620137/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The article presented is a result of investigations connected to the problems of the software creation for the linear accelerator automatic control system. The problems considered arise before each scientific group engaged in the development of the automatic control complex for a physical installation. The possible ways of solving such problems are discussed. 54 refs.

37077 (INIS-SU–87/A, pp. 33-34) **Ion source with peripheral magnetic field.** Il'in, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki); Kolomiets, A.A.; Petrenko, S.V.; Khromov, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Ion source with peripheral magnetic field for injector of linear proton accelerator with spatial-uniform quadrupole focusing is developed in ITEP. The source design and its performance data are presented. The beam current being 150 mA and injection energy - 40 keV, the normalized emittance constitutes 0.05 cmxmrad. 4 refs.; 3 figs.

37078 (INIS-SU–87/A, pp. 58) **Electron injector for high-voltage model of collective accelerator.** Belikov, V.V. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.); Zvyagintsev, A.V.; Lymar', A.G.; Martynenko, P.A.; Khizhnyak, N.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

The design and test results of an electron gun with the beam compression and axial hole aimed at collective acceleration are presented. The electron gun is tested at 150 kV, the pulse duration being 12 ms. The hallow beam has 10 mm in diameter, with 1 mm thick wall, that corresponds to the compression degree of 200. The beam microperveance is 4.5 $mA/V^3/2$. 1 ref.; 1 fig.

37079 (INIS-SU–87/A, pp. 61-63) **Choice of the cathode for the injector of the LIU-5/5000 linear induction accelerator.** Pershin, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki); Popova, N.Ya. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

On the basis of experimental investigaions exponential and performance testing comparison of emission characteristics of thermoelectron oxide barium-nickel and desorption slit cathode is carried out. Recommendation to their application in high-current injectors of linear induction accelerators is made. It is stated that oxide cathodes at emission current densities of $\geq$ 20 A/cm^2 emit electrons due to Schottky effect that sharply worsens uniformity of emission

density and its stability along cathode surface as well as decreases cathode service life. Desorption slit cathodes provide for stable emission with the uniformity of ±10% and have unlimitted service life, the current densities being 20-50 A/cm^2. They are under testing at pulse repetition frequency of 20 kHz. 5 refs.; 2 figs.; 1 tab.

37080 (INIS-SU–87/A, pp. 6-7) **Amplification klystron for resonance electron accelerators.** Bystrov, V.M. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)); Galaktionov, S.V.; Demin, V.E.; Frejdovich, I.A.; Vakhrushin, Yu.P.; Nikolaev, V.M.; Smirnov, V.L. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Development of a new amplification klystron operating in the frequency of 2450 Hz, the pulse power of 5 MW and average power of 5 kW is completed. The klystron is distinguished by low anode voltage and package design. The klystron gain factor is ~ 50 db. HF-pulse duration up to 7 μs. Weight of klystron with the mounted permanent magnet focusing system is about 85 kg. The first klystron performance testing confirmed that it may be advantageously used in linear electron accelerators for radiotherapy and industrial radiography. 1 ref.; 1 fig.; 1 tab.

37081 (INIS-SU–87/A, pp. 37-39) **Test results for experimental set of powerful pulse klystrons of RF channel of the meson factory's linear accelerator.** Amosov, I.I. (AN SSSR, Moscow (USSR). Inst. Yadernykh Issledovanij); Vetokhov, V.M.; Kiselev, I.V.; Leont'ev, V.N.; Peplov, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Methods and results of measuring performances of experimental set of powerful pulse klystrons of RF channel of the meson factory's linear accelerator are presented. The measurement errors are estimated. The output pulse power dependences on the excitation power, on focusing solenoid current, amplitude-frequency and filament characteristics of klystrons are presented. Analysis of obtained results permit to conclude that the test klystrons satisfy accelerator conditions and may be included into their complex. It is shown that change of cold tuning permits to improve parameters of some instruments important for amplitude-phase efficient autoregulation. 2 refs.; 5 figs.

37082 (INIS-SU–87/A, pp. 55-57) **On the possibility of construction of the parallel-coupled structure for the small-energy electron linear accelerator.** Ivannikov, V.I. (AN SSSR, Novosibirsk (USSR). Inst. Khimicheskoj Kinetiki i Goreniya); Chernousov, Yu.D.; Shebolaev, I.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Experience in construction of accelerating parllel-coupled structures (PCS) shows that they may be used in the low-energy electron linear accelerator. The PCS consists of transmitting waveguide and lengthwise accelerating cavity resonators. Each resonator is coupled only with transmitting waveguide with travelling waves. Method of resonator reflection compensation and synchronization accelerating field with charged particles are considered. One structure variant is tested using a beam and high SHF power. The accelerated electron output energy attains 1.7 MeV, the current - 0.6 and 0.1 A, the pulse duration being 5 ns and 2 μs, respectively. 2 refs.; 5 figs.

37083 (INIS-SU–87/A, pp. 35-36) **Measuring RF field distribution in the 4-chamber H-resonator using microcomputer.** Andreev, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki); Belyaev, V.I.; Burov, A.A.; Gusev, M.L.; Kozodaev, A.M.; Kolomiets, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

A system for measuring RF field distribution in the 4-chamber H-resonator using Mera-60 microcomputer is constructed in ITEP spatial-uniform quadrupole focusing accelerator. RF signals from measuring loops are processed, coded and sent to Mera-60 microcomputer. Final information is displayed and printed. 6 refs.: 3 figs.

37084 (INIS-SU–87/A, pp. 44-45) **Stabilization of charging voltage in high-voltage linear modulator with optron control circuit.** Kozodaev, A.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki); Kuz'michev, V.G.; Kyrs, A.R.; Stasevich, Yu.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 4(35).

Artificial lines are most often used as energy accumulators in high-voltage pulse shapers. Due to this fact there are some features that must be taken account of in developing the line charging voltage stabilization systems. The present report is concerned with such system designed for I-2 accelerator high-voltage modulators. Peculiarities of charging voltage stabilization at pulse modulator shaping line are considered. The system has an analog signal convey option channel. Frequency characteristics of the channel and the system stability are discussed. The line charging voltage variation pitch is 5 V for 2-5 kV range and 10 V for 2-10 kV range. The voltage instability is not over ± 0.1%. The line charging time up to 8 kV is 0.1 s, up to 10 kV - 0.35 s. 2 refs.; 3 figs.

37085 (IYaF–88-24) **Driver and controller for the Odrenok computer.** Kozak, V.R. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 12p. (In Russian). Order Number DE89620148/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In the Institute of Nuclear Physics SO AN SSSR a series of controllers for valrious computer types is developed. A driver-controller set for connection of periphery crate to the system crate with the ODRENOK microcomputer, as well as the package of subprograms for their maintenance, are described. The B0614 driver and K0614 controller permit to connect periphery crates at the distance of 0 - 100 m with the time of CAMAC-istruction execution ≤ 10 μs. Connection is realized via two coaxial cables. The transmitter and receiver have a galvanic decoupling on fast responding optopairs. Both units are realizeed in CAMAC modules 2M width. 3 refs.; 4 figs.

37086 (JINR–13-88-470) **Program for calculating parameters of atomic beam of polarized particle source and jet polarized targets on 'Pravets-16'.** Kulikov, M.V.; Fimushkin, V.V.; Tsvineva, G.P. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1988. 6p. (In Russian). Order Number DE89620127/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Program for calculating the parameters of atomic beam of polarized particle sources and jet polarized targets is described. The program is adapted on PC 'Pravets-16' having a coprocessor. It permits to calculat any of four states of hydrogen atoms and any of six states of deuterium atoms. It calculated the distributions of intensity and density of the beam behind the focusing magnets, average values of intensity and density, effective thickness of the beam as target and other parameters. The data are extracted into separate file in a readable format. 6 refs.; 5 figs.

37087 (JINR-R–9-88-383) **Results of experimental investigation of injector part of the LIU-30 accelerator.** Vakhrushin, Yu.P.; Volzhev, A.A.; Demskij, M.I. and others. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics. 1988. 10p. (In Russian). Order Number DE89620135/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Matching of injector part(IP) to 3 MeV energy is carried out in the 30 MeV linear induction accelerator (LIU-30) where 250 A current electron beam is to be obtained with 500 ns duration pulse. Measurement of beam parameters was carried out with diagnostics apparatus complex. It consist of the systems for measuring emittance, profile and energy spectrum of the beam, amplitude of coherent oscillations after each current pulse in time intervals of 40 ns duration. Due to replacement of electron source with Pierce optics on the basis of compacted oxide-nickel cathode and application of grid in anode orifice magnetic field flattening on injector part up to ±15% tuning of the pulse system of accelerating section supply the following parameters are achieved: rectangular shape current pulse of 240 A for 400 ns peak duration and 500 ns pulse duration on 0.5 height. The focusing longitudinal magnetic field grows monotonically from 0.03 up to 0.04 T. Energy spread was 9% from E_{max} by the distribution curve base and 5% on the 0.5 height. Emittance was not worse than 0.2 cm. rad. 3 refs.; 7 figs.

37088 (LA-UR–89-965) **High-brightness electron injectors: A review.** Sheffield, R.L. Los Alamos National Lab., NM (USA). 1989. 6p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890335–215: 13. particle accelerator conference, Chicago, IL, USA, 20-23 Mar 1989). Order Number DE89014244/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The last decade has seen increased emphasis on the development of high-brightness electron beams because of rigorous requirements of the new generation of colliders and the advent of free-electron lasers. This talk describes the approaches now being explored for attaining intense, bright electron beams. The methods for producing bright electron beams include photocathode-based, short-pulse injectors; dc electrostatic accelerator sources; long-pulse beams, which are then compressed in time using subharmonic bunching; combining first and third harmonics in an accelerator to attain the equivalent of high-gradient dc fields; and LaB_6 rf guns. For several of the approaches, the temporal length of the electron pulse is decreased after acceleration to relativistic energies by impressing an energy spread on the electron bunch and using a nonisochronous beam-transport system to increase the peak current. 37 refs., 7 figs.

37089 (LA-UR–89-2071) **Influence of a biased beam dump on H^- beam neutralization measurements with a four-grid energy analyzer.** Sherman, J.; Pitcher, E.; Allison, P. Los Alamos National Lab., NM (USA). 1989. 16p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-36;AC03-76SF00098. (CONF-890703–9: International conference on ion sources, Berkeley, California, USA, 9-15 Jul 1989). Order Number DE89014299/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A four-grid energy analyzer (FGA) diagnostic has been developed for the study of H^- beam space-charge compensation, and first measurements have been reported previously. Biased beam-dump measurements were undertaken to clarify the origin of electron currents measured in the FGA because they far exceeded predictions based on H^- beam ionization and stripping processes. This experiment partially explains the anomalously large radial electron current. The FGA observations for beam-dump bias <0 suggest electron ionization of the background gas is an additional mechanism for producing positive ions, where the electron kinetic energy is derived form the beam-dump voltage. 6 refs., 4 figs.

37090 (LA-UR–89-2080) **The Mark 101 flux compression generator: Development progress.** Freeman, B.L.; Fowler, C.M.; Rickel, D.G.; Hodgdon, M.L. Los Alamos National Lab., NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890710–10: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014298/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Mark 101 explosive flux compression generator is a line-initiated, helical generator that offers the possibility of a theoretical $dL/dt \geq 0.5\ \Omega$. The design and initial tests were reported by Fowler, et al. and Freeman, et al. Subsequent to the early results, which demonstrated current gains of only ~1.2:1, the generator design was modified and now includes a low-density foam staging layer between the PBX 9501 explosive and the aluminum armature and a vinyl coating on the stator winding. This redesigned Mark 101 has an initial working inductance of 5.36 μH and a load inductance of 0.60 μH. The lossless current gain of this unit is 9.9:1, and the estimated practical gain is ~5.5. Experiments have been performed using SF_6 and vacuum as the insulating media between the armature and stator. Measured current gains of ~5.0:1 have been achieved. The maximum measured dI/dt of $\sim 1.2 \times 10^{11}$ Amps/sec and V of ~62 kV were significantly less than expected during high-current tests. However, a case motion experiment has shown that the armature is probably disintegrating during the last few microseconds of the armature run. Thus, the configuration of the staging layer between the explosive and the armature has been the subject of study. The results of the generator tests are presented. 5 refs., 8 figs.

37091 (ORNL/FTR–3272) **[International conference on electrostatic accelerators (ICEA), Strasbourg, France and Heidelberg, Germany, and discussion of electron cyclotron resonance ion sources, Grenoble, France, May 23–29, 1989]: Foreign trip report.** Ziegler, N.F. Oak Ridge National Lab., TN (USA). 14 Jun 1989. 7p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014730/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler visited the Centre d'Etudes Nucleaire Grenoble to view and learn of the electron cyclotron resonance ion sources being built there. A permanent magnet electron cyclotron resonance ion source called NEOMAFIOS may have application in the HHIRF tandem accelerator. In addition, the traveler attended the International Conference on Electrostatic Accelerators, which was convened in Strasbourg, France, with final sessions in Heidelberg, Germany. In general, the many papers presented dealt with status, problems, improvements, and applications of electrostatic accelerators and their associated booster accelerators.

37092 (SAND–88-3360C) **Compound-lens diode for HERMES III.** Sanford, T.W.L.; Halbleib, J.A.; Poukey, J.W.; Sheridan, T.; Muirhead, D.; Yagow, C.E.; Mikkelson, K.A.; Mock, R.; Spence, P.W.; Bailey, V.L. Sandia National Labs., Albuquerque, NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890665–25: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89013065/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Significantly improved spatial uniformity of bremsstrahlung radiation, relative to a diode with a planar anode, is predicted for the HERMES III accelerator when a compound-lens diode is used to actively control the high-power electron beam at the exit of a coaxial, magnetically-insulated transmission line. Electron flow within the diode and subsequent radiation output is characterized as a function of diode parameters. The results of these calculations are applicable to coaxial geometries where active control of high-energy, high-current, $\nu/\gamma \geq 1$ beams is desired. 8 refs., 6 figs.

37093 (SAND–89-0523) **BUCKSHOT simulations of beam injection on the recirculating linac.** Wagner, J.S.; Mazarakis, M.G. Sandia National Labs., Albuquerque, NM (USA). Apr 1989. 42p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89014615/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

One critical issue to be addressed in the compact recirculating linac program concerns optimal beam injection into a racetrack-shaped accelerator. There are at least three candidates, axial beam

injection, tangential beam injection, and laser-channel-assisted beam injection. In this report these three approaches are examined using computer simulation techniques. 3 refs., 27 figs., 2 tabs.

37094 (SLAC-PUB–4893) **RF phase distribution systems at the SLC.** Jobe, R.K.; Schwarz, H.D. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Apr 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–207: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89013755/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Modern large linear accelerators require RF distribution systems with minimal phase drifts and errors. Through the use of existing RF coaxial waveguides, and additional installation of phase reference cables and monitoring equipment, stable RF distribution for the SLC has been achieved. This paper discusses the design and performance of SLAC systems, and some design considerations for future colliders. 6 refs., 4 figs.

37095 (SLAC-PUB–4926) **Recent commissioning experience on the SLC Arcs.** Toge, N.; Bambade, P.; Barklow, T.; Brown, K.L.; Bulos, F.; Burke, D.L.; Fieguth, T.; Haiessinski, J.; Hutton, A.; Jung, C. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Apr 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–205: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89013753/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Arc transport line, which brings high-energy, high-intensity electron and positron bunches from the SLAC linac to the Stanford Linear Collider final focus section, has been in operation for the past few years. In this paper, we will review the techniques developed for the optical tune-up and diagnostics, recent performance, and on-going improvement programs. 13 refs., 4 figs., 1 tab.

37096 (SLAC-PUB–4961) **An alignment method for the Mark II silicon strip vertex detector using an x-ray beam.** Adolphsen, C.; Gratta, G.; Labarga, L.; Litke, A.; Schwarz, A.; Turala, M.; Zaccardelli, C.; Breakstone, A.; Parker, S.; Barnett, B. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Apr 1989. 21p. Sponsored by DOE Energy Research. DOE Contract AA03-76SF00034;AC03-83ER40103. (CONF-890247–3: 5. European symposium on semiconductor detectors: new developments on radiation detectors, Munich, Germany, F.R., 21-23 Feb 1989). Order Number DE89014588/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A silicon strip vertex detector consisting of 36 independent detector modules is being constructed for use in the Mark II detector at the SLAC Linear Collider. This paper describes a method for determining the relative alignment of the modules to a precision better than the 5 μm intrinsic resolution of the detectors. The basic procedure involves moving the vertex detector by known amounts through a fixed, collimated x-ray beam, and using the beam position reconstructed from the detected signals to determine the relative positions and orientations of the modules. Results from tests of the method on a subset of detectors are presented. 5 refs., 11 figs.

37097 Neutron transmission of single crystal MgO filters. Carpenter, J.M. (Argonne National Lab., IL (USA). Intense Pulsed Neutron Source); Mildner, D.F.R.; Cudrnak, S.S.; Hilleke, R.O. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment (Netherlands),* 278(2): 397-401 (1 Jun 1989).

We have measured and analyzed the wavelength dependence of the transmission probability of a beam of neutrons passing through a single crystal MgO filter at 77 K. The 12.7 cm filter transmits 70% or more of the incident beam at wavelengths greater than about 1.8 A. At shorter wavelengths the transmission probability drops sharply, with 50% transmission occurring at about 1.2 A, and 1% transmission for the range 0.1-0.4 A. We have determined that cooling the filter to 77 K improves the transmission of >1 A neutrons, while further cooling to 25 K shows little additional improvement, and no improvement for short wavelengths. We have identified the wavelengths of the sharp dips in the transmission found in this region caused by Bragg scattering in MgO. We also show how these peaks may be used to calibrate the wavelength scale of time-of-flight measurements taken on instruments using similar filters.

4304 Storage Rings

Refer also to citation(s) 36910, 36919, 36924, 36925, 36933, 36939, 36940, 36946

44 INSTRUMENTATION

4401 Radiation Instrumentation

Refer also to citation(s) 35597, 36108, 36910, 36934, 37070, 37096, 37491, 37500, 37566, 37577, 37584, 37586, 37591, 37593, 37594, 37659

37098 (AD-A–205808/9/XAB) **Intercomparison of neutron-dosimetry techniques at the AFFRI (Armed Forces Radiobiology Research Institute) TRIGA reactor.** Zeman, G.H.; Dooley, M.; Eagleson, D.M.; Goodman, L.J.; Schwatz, R.B. Armed Forces Radiobiology Research Inst., Bethesda, MD (USA). 1988. 5p. (AFRRI-SR–88-49). Available from NTIS, PC A02/MF A01.

Pub. in Radiation Protection Dosimetry, Vol. 23, No. 1-4, 317-320(1988).

NEUTRON DOSiMETRY/comparative evaluations; AFRRI REACTOR/neutron dosimetry; RADIATION PROTECTION; MILITARY FACILITIES; REACTOR EXPERIMENTAL FACILITIES

37099 (AERE-R–13103) **Neutron spectrometry measurements with large volume cylindrical proton-recoil counters developed for use in radiological protection.** Delafield, H.J.; Birch, R. UKAEA Harwell Lab. (UK). Environmental and Medical Science Div. Feb 1989. 26p. Available from H.M. Stationery Office, London, price Pound 8.00.

A transportable neutron spectrometry system, based on four large-volume cylindrical proton-recoil counters, has been developed and calibrated for high-resolution measurements of neutron spectra in radiological protection. The counters cover an energy-range from about 50 keV to 2 MeV and can be used in dose-equivalent rates from about 5-50 μSv h^{-1}. The angular response of this system has now been studied. Measurements with the cylindrical counters at different angles of incidence to the neutron source were made for the leakage spectrum of fission neutrons through the NESDIP3 shield at the NESTOR reactor (AEE Winfrith). In addition, a direct comparison has been made of spectrum measurements (NESDIP3 shield and an ^{241}Am-Li (α,n) source), with those obtained using the smaller volume spherical counters (type SP2).

37100 (AERE-R–13159) **High-dose intercomparison study involving red 4034 perspex and radiochromic dye films.** Barrett, J.H.; Sharpe, P.H.G.; McLaughlin, W.L.; Glover, K.M.; Watts, M.F.; Whittaker, B. UKAEA Harwell Lab. (UK). Chemistry Div. Oct 1988. 32p. Available from H.M. Stationery Office, London, price Pound 10.00.

The present dosimetry intercomparison exercise involved the National Bureau of Standards (NBS) Gaithersburg MD, USA; the National Physical Laboratory (NPL) Teddington, and Harwell Laboratory, UK. It was undertaken as an extension of previous intercomparison exercises and forms part of an on-going calibration and quality-assurance programme for those in-plant dosimetry systems widely used in radiation sterilisation. Two dosimetry systems, Harwell red 4034 Perspex and Far West Technology radiochromic dye film (FWT-60-00) were used. The dosimeters were irradiated with cobalt-60 gamma radiation at absorbed dose rates in the range 1-4 Gy s^{-1} to absorbed doses in the range 10-35 kGy. Irradiations were carried out at each of the participating laboratories, and the irradiated dosimeters were carried by hand between laboratories to eliminate any possibility of maltreatment which might occur if conventional modes of transport such as air freight were used. A minimum of four dosimeters were irradiated at each dose and the elapsed time between irradiation and spectrophotometric reading of the dosimeters varied from one to nine days. The following comparisons were made: laboratory spectrophotometric readings at the accepted measurement wavelengths (radiochromic film: 605

nanometers (nm); red 4034 Perspex: 640 nm); dosimeter thickness measurements; estimates of absorbed dose. Measurement precision was in all cases better than ± 1.5% one sigma. The agreement obtained between laboratory estimates of absorbed dose and between spectrophotometric readout was within ± 2% for both dosimetry systems.

37101 (CRN-HE--87-08) **Ring imaging Cherenkov detector. The DELPHI Barrel RICH Prototype. Part B: Experimental studies of the detector performance for particle identification.** Arnold, R.; Christophel, E.; Dracos, M.; Guyonnet, J.L.; Baillon, P.; Bosteels, M.; Giomataris, Y.; Passardi, G.; Besch, H.J.; Seguinot, J. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 1987. 56p. Order Number DE89789271/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

We present, in this Part B of the DELPHI Barrel RICH Prototype studies, a test beam investigation of the detector performance for particle identification. The tests have been done with both a proximity focused radiator of 1.cm of liquid perfluoro-hexane C_6F_{14} and a focusing gas radiator of isobutane (50 cm mirror focal length). In the accompanying paper, Part A, are given a technical description of the Propotype, the single photoelectron detector response and the spatial resolution attainable which are used throughout this article. The results show that the Prototype performance predicted by Monte Carlo simulations, as a function of the drift distance z_d and the particle incidence angle θ_b, have been achieved (particle identification between .7 and 30 GeV/c). The calculations use the known and measured properties of the detector components which have been discussed throughout Parts A and B. The single photon Cherenkov angle resolution obtained at $z_d = 0$ drift distance is 8.5 mrad and 4.5 mrad for the liquid and the gas (at $\theta_b = 0^0$) radiators respectively, as expected from the design. The numbers of detected photoelectrons in the images are 21 and 12 which correspond to a detector merit factor N_0 of 53 cm^{-1} and 77 cm^{-1} for the liquid and gas radiators respectively. These numbers are in agreement with the calculations but are limited because of the actual multiwire photoelectron detector performance. We show that N_0 = 65 cm^{-1} and 96 cm^{-1} are achievable for the liquid and gas radiators respectively. These last figures include a 90% cathode strip readout efficiency (third measurement coordinate for parallax correction) but no correction for dead space between drift volumes (liquid images only) and electronic dead time.

37102 (DOE/ER/03130--5) **An Outstanding Junior Investigator Award in experimental high energy physics: Progress report, January 1, 1989 to December 31, 1989.** Partridge, R. Brown Univ., Providence, RI (USA). Dept. of Physics. 1 Jul 1989. 22p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER03130. Order Number DE89013931/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An experimental program based upon the study of hadron collisions at the highest available energy is being carried out with the support of an Outstanding Junior Investigator Award to Dr. Richard Partridge. The work described in this report includes the development of the Level 0 trigger for the DØ experiment at Fermilab, preparation for the DØ physics program, and studies of detector design and physics at the Superconducting Super Collider (SSC).

37103 (DOE/ER/03130--41C) **A microprocessor farm architecture for high speed data acquisition and analysis.** Cutts, D.; Hoftun, J.S.; Johnson, C.R.; Zeller, R.T. Brown Univ., Providence, RI (USA). Dept. of Physics. 1988. 2p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER03130. (CONF-881103--64: IEEE nuclear science symposium, Orlando, FL, USA, 9-11 Nov 1988;COO--3130TC-41). Order Number DE89013961/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The D0 Level-2 data acquisition system has been described in several previous articles. This paper will briefly discuss the requirements and architecture of the system as well as its current status, and then consider its implementation using a new generation of hardware which is currently under development. Details of the system software appear elsewhere, and will not be considered. 4 refs., 4 figs.

37104 (DOE/ER/03130--43C) **Neural networks, D0, and the SSC.** Barter, C.; Cutts, D.; Hoftun, J.S.; Partridge, R.A.; Sornborger, A.T.; Johnson, C.T.; Zeller, R.T. Brown Univ., Providence, RI (USA). 1989. 12p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER03130. (CONF-8901118--4: Workshop on triggering and data acquisition for experiments at the Superconducting Super Collider, Toronto, Canada, 16-19 Jan 1989). Order Number DE89013954/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We outline several exploratory studies involving neural network simulations applied to pattern recognition in high energy physics. We describe the D0 data acquisition system and a natual means by which algorithms derived from neural networks techniques may be incorporated into recently developed hardware associated with the D0 MicroVAX farm nodes. Such applications to the event filtering needed by SSC detectors look interesting. 10 refs., 11 figs.

37105 (DOE/ER/03130--44C) **Data acquisition at D0.** Cutts, D.; Hoftun, J.S.; Johnson, C.R.; Zeller, R.T. Brown Univ., Providence, RI (USA). 1989. 10p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER03130. (CONF-890415--6: Computing in high energy physics, Oxford, UK, 10-14 Apr 1989). Order Number DE89013955/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A large array of MicroVAX computers will be used for high-speed data acquisition and online filtering in the D0 experiment at Fermi National Accelerator Laboratory. We discuss new developments related to this system, in hardware and particularly in software. The new hardware includes multiported memory boards for faster and more direct input and output of event data. Most of the software development is related to the crucial role of the event filters, requiring an elaborate mechanism for control and monitoring of the FORTRAN based programs running in each of the MicroVAXes. 4 refs., 2 figs.

37106 (DOE/ER/03130--45C) **Neural networks for event filtering at Dv.** Cutts, D.; Hoftun, J.S.; Sornborger, A.; Johnson, C.R.; Zeller, R.T. Brown Univ., Providence, RI (USA). 1989. 13p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER03130. (CONF-890415--7: Computing in high energy physics, Oxford, UK, 10-14 Apr 1989). Order Number DE89013956/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Neural networks may provide important tools for pattern recognition in high energy physics. We discuss an initial exploration of these techniques, presenting the result of network simulations of several filter algorithms. The D0 data acquisition system, a MicroVAX farm, will perform critical event selection; we describe a possible implementation of neural network algorithms in this system. 7 refs., 4 figs.

37107 (DOE/ER/40150--82) **Workshop on CEBAF [Continuous Electron Beam Accelerator Facility] spectrometer magnet design and technology: Proceedings.** Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility. Sep 1986. 494p. Sponsored by DOE Energy Research. DOE Contract AC05-84ER40150. (CONF-8604413--: Workshop on CEBAF spectrometer magnet design and technology, Newport News, VA, USA, 7-11 Apr 1986). Order Number DE89014429/JAW. Available from NTIS, PC A21/MF A01 - OSTI.

The planned experimental program at CEBAF includes high-resolution, large acceptance spectrometers and a large toroidal magnetic, detector. In order to take full advantage of the high quality beam characteristics, the performances required will make these devices quite unique instruments compared to existing facilities in the same energy range. Preliminary designs have shown that such performances can be reached, but key questions concerning design concepts and most appropriate and cost-effective technologies had to be answered before going further with the designs. It was the purpose of the Workshop on CEBAF Spectrometer Magnet Design and Technology, organized by the CEBAF Research and Engineering Divisions, to provide the most complete information about the state-of-the-art tools and techniques in magnet design and construction and to discuss the ones most appropriate to the CEBAF spectrometers. In addition, it is expected that this Workshop will be the staring point for further interactions and collaborations between international magnet experts and the CEBAF staff, during the whole process of designing and building the spectrometers.

37108 (DOE/ER/40315–157) **Technical advisory panel for the large acceptance spectrometer: Final report.** Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Physics. 20 Jan 1989. 31p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER40315. Order Number DE89014471/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Technical Advisory Panel for the Large Acceptance Spectrometer met on November 17–19, 1988, at CEBAF to perform a second review of the status of this project. The charge to the Panel was "to provide technical advice to the CEBAF directorate on the design, construction, cost, schedule, and implementation of the Large Acceptance Spectrometer." In this written report, an overview of the entire project is given. Specific comments on the major components, data handling and analysis, assembly and installation, and management are presented. The Panel's conclusions are contained in the Executive Summary at the beginning of the report.

37109 (DOE/ER/40372–T1) **Development of new scintillating fiber detectors for high energy physics applications.** Ruchti, R.; Baumbaugh, B.; Bose, A.; Ditmire, T.; Kennedy, C.; Puseljic, D.; Ryan, J.; Baumbaugh, A.; Knickerbocker, K.; Ellis, J. Notre Dame Univ., IN (USA). Dept. of Physics. 1988. 5p. Sponsored by DOE Energy Research. DOE Contract AC02-87ER40372;AC02-76CH03000. (UND-HEP–11-29-88;CONF-881103–63: IEEE nuclear science symposium, Orlando, FL, USA, 9-11 Nov 1988). Order Number DE89013678/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

We have been developing new scintillating fiber detectors for colliding beam and fixed target applications. In this paper, we present initial results from a development study of high refractive index, liquid scintillator, and the incorporation of these liquids into glass capillaries. Advantages of liquid in-capillary fiber detectors include: high efficiency and fast decay; the potential for high-resolution tracking as light emission is expected to be local to the deposited ionization in liquids containing single solutes; the potential for good radiation resistance and replaceability. 13 refs., 2 figs., 3 tabs.

37110 (GSI–89-36(prepr.)) **Plastic Ball experiments.** Gutbrod, H.H.; Poskanzer, A.M.; Ritter, H.G. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.). Apr 1989. 100p. Available from Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

The Plastic Ball spectrometer is a 4π detector with particle identification for charged particles. It was first used at the Berkeley Bevalac to study nucleus-nucleus collisions at beam energies of hundreds of MeV per nucleon. Recently it has been moved to the CERN SPS for studies of target fragmentation at energies of hundreds of GeV per nucleon. This article gives a complete review of the spectrometer and the physics obtained at the Bevalac, with some recent additions from the work at CERN.

37111 (INIS-SU–82, pp. 19-21) **Calibration and testing of the DMG gamma dosimeter.** Dolgirev, E.I. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

25-1000 nGy/h (2.5-1000 μrad/h) absorbed dose gamma dosimeter for measuring the efficient equivalent irradiation dose for population is developed. It has two subranges 1000 nGy/h and 250 nGy/h. Results of dosimeter calibration and testing are presented. The dosimeter error for both subranges is less than 10%. 1 tab.

37112 (INIS-SU–82, pp. 14-18) **Radiometric analysis of probes of environmental objects.** Kajdanovskij, G.N. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Development of high-sensitive detection system for radiometric analysis of probes of environmental objects is substantiated. The detector is a system of three proportional ionization chambers with 90% argon and 10% methane or pure methane working fluid. The first chamber is for alpha detection, all energy beta and background radiation detection. The third chamber is only for the background radiation detection. The detection unit is within the lead shield. The signals are processed by a logic unit. 4 refs.; 1 fig.

37113 (INIS-SU–82, pp. 154-157) **Units for detecting surface contamination by alpha radionuclides.** Ershov, E.B.; Ivanov, Yu.A.; Yakovlev, V.A. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Two variants of units for detecting surface contamination by alpha radionuclides are developed. In both variants the detecting parts include a detector in the form of zinc sulphide deposited on acrylic plastic, photomultiplier and high-voltage divider with a pulse shaper. All detector elements are enclosed in cylindrical metallic sleeve. The minimum surface contamination by alpha radionuclides is 0.06 particles/cm^{2}xmin, the measurement error being 20%, the measurement time-1 h. The detection unit mass is 0.9 kg.

37114 (ISN–88-03) **Thermal neutron detection with a lithium-6 loaded liquid scintillator.** Ait-Boubker, S.; Avenier, M.; Kerret, H. de; Lefievre, B.; Cousinou, M.C.; Declais, Y.; Aleksan, R.; Bouchez, J.; Besson, P.; Borel, H. and others. Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires. 1988. 20p. Order Number DE89789232/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Light yield, light transmission and pulse shape discrimination properties of NE320, a liquid scintillator based on pseudocumene and loaded with 0.15% of lithium-6 have been measured. Excellent pulse shape discrimination performances were obtained with a 100cm^3 cell, while its large transmission length permits its use in large volume detector.

37115 (JINR-R–15-88-479) **Ionization chamber-detecting setup of Vasilisa installation for the study of characteristics of total fusion reaction product decay.** Szaro, S.; Zejnalov, Sh.S.; Mikhajlov, K.V.; Popeko, G.S.; Ter-Akopyan, G.M. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions. 1988. 10p. (In Russian). Order Number DE89620296/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Operation of a double ionization chamber of a detecting setup of electrostatic separator of total fusion reaction products Vasilisa installation is described. It is shown that such ionization chamber permits to study α-decay and spontaneous fission of nuclei with half-life more than 40 ms. Efficiency of registration of nuclear α-decay is near 45%, efficiency of registration of spontaneous fission nuclei - about 90%. Cross section of $^{232}Th(^{31}P,5n)\ ^{258}105$ reaction was estimated to be equal to $\sigma \leq 5x10^{-34}cm^2$. Velocities of actinium ion drift in 90% Ar + 10% CH_4 gaseous mixture for different voltages of electrostatic field and 250 Torr pressure have been measured. The possibilities of improvement of the chamber for study of decay characteristics of nuclei with shorter lifetimes are discussed. 8 refs.; 4 figs.; 2 tabs.

37116 (LYCEN–88-43) **AMPHORA detector.** Drain, D.; Billerey, R.; Chambon, B.; Cheynis, B.; Guyon, L.; Pastor, C.; Giorni, A.; Alarja, J.; Barbier, G.; Hilscher, D. and others; AMPHORA Collaboration. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1988. 27p. Order Number DE89789260/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

A 4π-multidetector consisting of 140 CsI(Tl) detectors has been designed and built to be used for detecting and identifying either charged-particles (with a low energy threshold of about 0.4 MeV/nucleon) and neutrons or light heavy-ions ad light charged-particles, in the range of energies available at S.A.R.A. (from 10 to 40 MeV/nucleon). The choice of the scintillator material is discussed and a description of the mechanical and electronic design is given. First experimental results obtained with this device are presented.

37117 (MPI-PAE/Exp.El.–197) **Development of new type of silicon detector with internal amplification.** Schuster, K.F. Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik; Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik. Nov 1988. 66p. (In German). Order Number DE89788401/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

The first test version of a new type of silicon detector made of extremely pure material was designed and manufactured. Numerical

simulation provided great assistance in selecting the process parameters. The principle of operation aimed at of a radiation deflector consisting of an MOS transistor with more than fully depleted base area was confirmed. The energy resolution of the detectors was determined at 300^{0}K and 6 keV (Mn K_α) to be 250 eV half width and is therefore considerably better than the conventional uncooled detectors. The detector principle permits the realisation of a two-dimensional detector matrix which can be addressed, with non-destructive triggering. With a measured signal/noise ratio of the individual detectors of better than 400 for minimum ionised particles, new types of fast triggering processes can be achieved in high energy physics with good local resolution ($\simeq$ 50 μm).

37118 (OEFZS-A–1350) **Automatic programmable air sampling stations. Instruction manual.** Roetzer, H. Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. (Austria). Dec 1988. 8p. (In German). (IA–170/88). Available from the Austrian Research Centre Seibersdorf, A-2444 Seibersdorf (Austria).

Limited Distribution.

Programmable battery powered sampling stations were developed for the automatic collection of air samples at several locations of an inspected area. Eight air samples with a volume of about 5l can be collected sequentially with each sampling device. Time and duration of sampling can be chosen by initially programming the instruments. The manual gives the operating instructions, a list of the commands for programming the samplers and a short technical description of the instruments.

37119 (SLAC-PUB–4942) **Silicon PIN diode hybrid arrays for charged particle detection: Building blocks for vertex detectors at the SSC.** Kramer, G.; Gaalema, S.; Shapiro, S.L.; Dunwoodie, W.M.; Arens, J.F.; Jernigan, J.G. Stanford Linear Accelerator Center, Menlo Park, CA (USA). May 1989. 13p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890270–20: International industrial symposium on the super collider, New Orleans, Louisiana, USA, 8-10 Feb 1989). Order Number DE89014590/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Two-dimensional arrays of solid state detectors have long been used in visible and infrared systems. Hybrid arrays with separately optimized detector and readout substrates have been extensively developed for infrared sensors. The characteristics and use of these infrared readout chips with silicon PIN diode arrays produced by MICRON SEMICONDUCTOR for detecting high-energy particles are reported. Some of these arrays have been produced in formats as large as 512 x 512 pixels; others have been radiation hardened to total dose levels beyond 1 Mrad. Data generation rates of 380 megasamples/second have been achieved. Analog and digital signal transmission and processing techniques have also been developed to accept and reduce these high data rates. 9 refs., 15 figs., 2 tabs.

37120 (UCRL–53861-Vol.3) **Program listings for GRPANL: A suite of computer programs for analyzing complex Ge and alpha-particle detector spectra: Volume 3.** Gunnink, R.; Ruhter, W.D.; Niday, J.B. Lawrence Livermore National Lab., CA (USA). 14 Mar 1989. 201p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89014599/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

We use a suite of programs to analyze and interpret regions germanium and alpha-particle pulse-height spectra. GRPANL (GRouP ANaLysis) is the main peak-fitting program in this suite. Several other programs are used in support of or in conjunction with GRPANL. Some of these programs define parameters used in the analysis process. Determining these parameters is part of the calibration procedure for gamma-ray spectrometry system. This volume contains program listings for GRPANL.

37121 (Y/DW–783/R1) **Nonfilm radiography at the Oak Ridge Y-12 Plant.** Marshall, B.B.; Bell, Z.W.; Sworski, T.J. Oak Ridge National Lab., TN (USA). 17 Mar 1989. 19p. Sponsored by DOE Defense Programs. DOE Contract AC05-84OR21400. Order Number DE89014523/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Nonfilm, real-time radiography is being developed in a form applicable to U-6-Nb wt % alloy parts. A development facility is in operation for use in prototyping the equipment and methods to be used, and equipment for the production facility has been procured and is being installed. The production facility is scheduled to be transferred to production in FY 1990. Fully automated data acquisition and analysis methods have been developed and demonstrated on the development system. The software has been translated onto the production computer system and individually tested. A statistical comparison of nonfilm radiography, using the development facility, was completed in FY 1986. Results of this study indicate that the nonfilm method exhibits superior precision and accuracy but slightly poorer resolution than the normal film radiography. The nonfilm system also yielded a small number of "false alarms" apparently associated with the camera system. The size of the "false alarms" were less than the resolution limits of the system. A second statistical comparison of nonfilm radiography with conventional film radiography using actual production parts and the production facility is scheduled for FY 1990. 1 ref., 10 figs.

37122 Erratum to "hadron showers in a low-density fine-grained flash chamber calorimeter". Womersley, W.J. (Florida Univ., Gainesville (USA)); Walker, J.K.; Bogert, D.; Stutte, L.; Bofill, J.; Friedman, J.I.; Fuess, S.; Goodman, M.C.; Kendall, H.W.; Kistiakowsky, V. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment (Netherlands),* 278(2): 447-451 (1 Jun 1989).

Our recent paper (Nucl. Instrum. Methods A267(1988) p. 49-68) described an analysis of the energy deposition in hadronic showers at six incident particle energies from 33.8 to 415.4 GeV using the low-density fine-grained flash chamber calorimeter of the Lab C neutrino detector at Fermilab. More recent work on the subject has led us to revise some of the results presented for energies above 200 GeV. We present here revised results for the longitudinal and transverse energy deposition, and new coefficients for the parametrization of these curves. (orig./HSI).

37123 Superconducting detector for minimum ionizing particles. Gabutti, A. (Argonne National Lab., IL (USA)); Wagner, R.G.; Gray, K.E.; Kampwirth, R.T.; Ono, R.H. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment (Netherlands),* 278(2): 425-430 (1 Jun 1989). DOE Contract W-31-109-ENG-38.

Although the detection of α-particles by thin superconducting films has been demonstrated previously, detection of the significantly smaller energy deposited by minimum ionizing particles (mips) requires independent verification. In this paper, experiments using $\simeq$ 6 keV X-rays, which deposit energies comparable to mips, are used to show that the switching probability is smaller than predicted by the simplest energy balance model. As a result, the simplifying assumptions of this model are in question, and it is demonstrated that practical detectors of mips will greatly benefit from, and most probably require, superconducting transition temperatures which are close to a low operating temperature (e.g., 4.2 K). In addition, an existing thermal propagation model is shown to adequately describe the behavior of the normal region after switching.

37124 Sources of compensation in hadronic calorimeters. Goodman, M.S. (Oak Ridge National Lab., TN (USA)); Gabriel, T.A.; Di Ciaccio, A.; Wilson, R. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment (Netherlands),* 278(2): 441-446 (1 Jun 1989). DOE Contract AC05-84OR21400;AC02-76ER03064.

Monte Carlo simulations are presented using the CALOR code system to study the design of a large hybrid hadron calorimeter system employing a warm liquid active medium (tetramethylsilane, $Si(CH_3)_4$) and uranium plates in addition to a conventional Fe/plastic system. In the system described here, the uranium provides partial compensation by suppressing the electromagnetic cascade produced by incident electrons due to sampling inefficiencies. The results of the simulations also indicate that significant compensation is achieved (given small enough saturation) due to low energy recoil protons produced in collisions with low energy (1-20 MeV) cascade and fission neutrons in the active medium. Both compensation mechanisms are important to help balance the response of a calorimeter to incident electrons and hadrons, that is, to achieve a ratio of pulse heights (e/h$\simeq$1) which will lead to the best energy resolution.

37125 Residual gas beam profile monitor. Krider, J. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment (Netherlands),* 278(3): 660-663 (15 Jun 1989).

The design and performance of a beam profile monitor which presents no material to the beam is described. The detector, which has a 75 mm active width, operates from residual gas in the beam vacuum system. It provides 1 mm rms spatial resolution and 1 ms time resolution in a 1 μA beam at 10^{-7} Torr. Using a microprocessor based scanning ADC, a sequence of ten profiles can be acquired in as little as 100 ms. The monitor could be applied in other stored or extracted beams where the amount of material seen by the beam must be minimized.

37126 Retractable carbon fibre targets for measuring beam profiles at the SLC collision point. Bowden, G. (Stanford Linear Accelerator Center, CA (USA)); Burke, D.; Field, C.; Koska, W. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment (Netherlands),* 278(3): 664-669 (15 Jun 1989). DOE Contract AC03-76SF00515;AC02-76ER01112.

Retractable targets of carbon fibres with nominal diameters of 30, 7 and 4.5 μm have been in use at the collision point of the SLC (the SLAC Linear Collider). The target mechanism is compatible with the Mark II detector now in place at the collision point. Beam profiles are measured in horizontal and vertical axes by using magnetic dipoles to scan the beams across the fibres. Two signal detection mechanisms are available. Electron emission from the fibres is measured with the help of charge-sensitive amplifiers. Bremsstrahlung from the fibres is detected by downstream counters. Examples of measurements are given, and limits on the use of the techniques are discussed.

37127 Inclusion of correlations in the empirical selection of intranuclear cascade nucleons from high energy hadron-nucleus collisions. Alsmiller, F.S. (Oak Ridge National Lab., TN (USA)); Alsmiller, R.G. Jr. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment (Netherlands),* 278(3): 713-721 (15 Jun 1989). DOE Contract AC05-84OR21400.

The very high energy (5 GeV to 20 TeV) hadron-nucleus differential particle production model found in the Monte Carlo transport code FLUKA87 has been adapted for inclusion in the transport code HETC88. The empirical selection of intranuclear cascade nucleons has been modified to provide simple correlations with the randomly selected number of hadron-nucleon collisions. A standard method of calculating the excitation energy of the compound nucleus preceding an added evaporation step by assuming the particles are produced in a one-dimensional nuclear well is applied. This method, coupled with the above correlations, leads to improved correlations of the excitation energy with the A and Z of the compound nucleus, and then to greatly improved distributions of the residual nuclei following evaporation. The frequency distribution of low energy ($\beta<0.7$) charged particles show good agreement with experiment for 200 GeV protons incident on emulsions. Average multiplicities of shower and grey particles after evaporation for protons and pions incident on several elements are also compared with experiment.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

Refer also to citation(s) 37017

37128 (AERE-R–13399) **Mechanical degradation of polymer coated glass optical fibres under γ irradiation.** Norris, J.O.W.; Tribble, M.J. UKAEA Harwell Lab. (UK). Materials Development Div. Feb 1989. 18p. Available from H.M. Stationery Office, London, price Pound 8.00.

The structural integrity of an optical fibre is a prerequisite for its successful operation, and yet very little is known on how their mechanical properties are degraded by radiation. For some potential uses within the nuclear industry the total dose received by the optical fibre will exceed 10 kGy, and it is known that this does is sufficient to cause fracture of some types of optical fibre. This report details results from an experimental investigation into the tensile strength of polymer coated optical fibres when exposed to γ-rays. Six types of fibre, having different polymer coatings, were irradiated at 28 kGy/day until either they became too fragile or brittle to test, or they had received 3-5 MGy. A silicone + ETFE (ethylene-tetrafluoroethylene polymer) coated fibre showed a 60% reduction in its tensile strain at fracture (from 5.2% to 2.1%) after 0.1 MGy. A silicone + nylon coated fibre fared little better, with the nylon becoming very brittle after 0.5 MGy. In contrast, acrylate or silicone + acrylate coated fibres degraded much less rapidly, showing a >2% strain at failure after 2.9 MGy. The coating that degraded least was a new, experimental, polyimide polymer, whose mean strain at failure was 2.9% after 5.1 MGy. The increased lifetime conferred by using an acrylate (+ silicone) or polyimide coated fibre is sufficient to make it practical to use these optical fibres in environments where the 0.1 MGy limit of the silicone + ETFE coated fibre had previously made fibres an unattractive option. The report ends with a discussion on the mechanisms and factors that affect the rate of mechanical degradation. It is postulated that the poor performance of the ETFE coated fibre results from chemical attack of the glass surface by fluorine containing gaseous species, formed from radiolysis of the ETFE.

37129 (RAE-TM-Space–365) **Particle transport simulation for spaceborne, NaI gamma-ray spectrometers.** Dyer, C.S.; Truscott, P.R.; Sims, A.J.; Comber, C.; Hammond, N.D.A. Royal Aircraft Establishment, Farnborough (UK). Nov 1988. 10p. Order Number DE89620339/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Radioactivity induced in detectors by protons and secondary neutrons limits the sensitivity of spaceborne gamma-ray spectrometers. Three dimensional Monte Carlo transport codes have been employed to simulate particle transport of cosmic rays and inner-belt protons in various representations of the Gamma Ray Observatory Spacecraft and the Oriented Scintillation Spectrometer Experiment. Results are used to accurately quantify the contributions to the radioactive background, assess shielding options and examine the effect of detector and space-craft orientation in anisotropic trapped proton fluxes.

37130 (SAND–89-0334C) **A radiation-hardened 16/32-bit microprocessor.** Hass, K.J.; Treece, R.K.; Giddings, A.E. Sandia National Labs., Albuquerque, NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890723–5: 26. annual conference on nuclear and space radiation effects, Marco Island, Florida, USA, 24-28 Jul 1989). Order Number DE89008111/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A radiation-hardened 16/32-bit microprocessor has been fabricated and tested. Our initial evaluation has demonstrated that it is functional after a total gamma dose of 5Mrad(Si) and is immune to SEU from Krypton ions. 3 refs., 2 figs.

37131 (UCID–21731) **A probabilistic method for estimating system susceptibility to HPM.** Mensing, R.W. Lawrence Livermore National Lab., CA (USA). 18 May 1989. 13p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE89014307/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Interruption of the operation of electronic systems by HPM is a stochastic process. Thus, a realistic estimate of system susceptibility to HPM is best expressed in terms of the probability the HPM have an effect on the system (probability of effect). To estimate susceptibility of complex electronic systems by extensive testing is not practical. Thus, it is necessary to consider alternative approaches. One approach is to combine information from extensive low level testing and computer modeling with limited high level field test data. A method for estimating system susceptibility based on a pretest analysis of low level test and computer model data combined with a post test analysis after high level testing is described in this paper. 4 figs.

4403 Miscellaneous Instruments

Refer also to citation(s) 36345, 36411, 36617, 36726, 36848, 36854, 36961, 36984, 37035, 37148, 37149, 37441, 37812

37132 (CANMET–8801) **"Slip effects" in concentrated emulsions.** Pal, R.; Rhodes, E.; Mansour, N.A. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). 1988. 34p. (MICROLOG–88-06047). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In this study, rheological data obtained for various concentrated oil-in-water and water-in-oil emulsions from viscometers of different design and geometry have been analyzed and compared. The three types of viscometers used were: Couette viscometer (coaxial cylinder type), Weissenberg rheogoniometer (cone-and-plate), and Brookfield viscometer (rotating bob in an infinite fluid). In the case of oil-in-water emulsions, the flow curves obtained with the cone-and-plate viscometer are in close agreement with those given by the coaxial cylinder viscometer only when the oil concentrations are below 70%; for concentrations greater than 70%, the flow curves obtained from the two instruments are appreciably different. In the case of water-in-oil emulsions, the flow curves obtained from different instruments are in agreement only when water phase concentrations are below 60%; for water concentrations greater than 60%, the flow curves obtained are significantly different. The variation in the flow curves for the same concentration emulsions has been attributed to the presence of the "slip effect" in the cone-and-plate viscometer. This effect has been observed in capillaries and leads to the formation of a boundary layer of the continous phase. A mathematical model is presented that reconciles the various methods of measurement. 22 refs., 10 figs., 1 tab.

37133 (CONF-890619–3) **Multi-energy neutron detector for counting thermal neutrons, high-energy neutrons, and gamma photons separately.** Chiles, M.M.; McElhaney, S.A. Oak Ridge National Lab., TN (USA). 1989. 7p. Sponsored by Department of Defense. DOE Contract AC05-84OR21400. From 34. annual meeting of the Health Physics Society; Albuquerque, New Mexico, USA; 25-29 Jun 1989. Order Number DE89014761/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The need for an improved, compact, wide-energy neutron detector for neutron monitoring and surveillance in nuclear facilities and weapons storage, where a possibility of fission excursion exists, led to development of a single detector that is sensitive to thermal neutrons, high-energy neutrons, and gamma radiation. Previously, separate detectors have been required to count these three different radiations separately. This development is a great advantage when experimental space is limited. 4 figs.

37134 (DOE/ER/13576–3) **Non-linear optical interactions involving the real Gaussian field: Annual technical progress report, August 1, 1986–July 31, 1989.** Elliott, D.S. Purdue Univ., Lafayette, IN (USA). School of Electrical Engineering. Jul 1989. 7p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER13576. Order Number DE89014165/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In the past year we have developed a technique for creating the real Gaussian field, and in a related effort, have calculated the power spectrum of the intensity fluctuations of the light transmitted by a Fabry-Perot interferometer when a phase diffusion field is incident upon it. In this annual report we discuss progress made in these two efforts. 3 figs.

37135 (EGG–10617-1033) **In search of more output: Two strain gage bridge circuits revisited.** Noyes, R.P.; Kalinowski, J. EG and G Energy Measurements, Inc., Las Vegas, NV (USA). 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract AC08-88NV10617. (CONF-8906133–2: 15. transducer workshop, Cocoa Beach, FL, USA, 20-22 Jun 1989). Order Number DE89014039/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The emplacement of large loads via drill pipe is common in Nevada. EG and G Energy Measurements, Inc. is involved in instrumentation. The loading of the drill pipe is of interest and is often measured with strain gages. Sometimes the amount of loading is small relative to the size of the pipe and only produces strain level on the order of 500 to 1000 microstrain. These circumstances have led to implementation of practical methods of measuring these strain levels. The original measurements were made utilizing piezoresistive strain gages with gage factors on the order of 55. Although having large outputs, these gages posed other problems. As a need for more reliable measurements arose, more stable gages were used. These gages have lower output, on the order of 2; therefore, techniques were investigated to gain more output. These techniques used proven circuits and were investigated for the best practical use under our particular circumstances and environments. The results of these investigations will be reported, and conclusions given, in the summary of this presentation. 7 refs.

37136 (INIS-SU–76, pp. 13-15) **Effect of diffusion on flow-rate time-of-flight measurements.** Kebadze, B.V.; Tipikin, V.N.; Komissarov, Yu.O. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

Results of analysis of a one-dimensional mathematical model, permitting to consider the diffusion effect on flow-rate measurements using the time-of-flight method, are presented. Diffusion parameters were evaluated on base of experimental data obtained in electromagnetic flowmeter tests with the eddy label of a flow. Deviation from true flow rate owing to diffusion is ~ 1% at averaged rate of 0.5 m/s. For nominal coolant rates (3-5 m/s) the diffusion effect is negligible. 4 refs.; 2 figs.

37137 (LA–11525-MS) **Significant improvement in IR surface-temperature measurements.** Briles, S.D.; Bennett, G.A.; Larkin, T.H.; Worcester, P. Los Alamos National Lab., NM (USA). Jun 1989. 26p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-36. Order Number DE89014808/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Obtaining infrared (IR) surface-temperature measurements of miniature square targets on the order of 1.6 mm with a spatial resolution of 15 μm has recently become possible using the Barnes Engineering Computherm System, but the accuracy and precision of the measurements have been limited. The objective of this work is to provide a calibration procedure that will improve by a factor of 8 the accuracy and precision of the two-dimensional temperature measurement. The IR microscope detects energy emitted by the target and displays it as a radiance image. Heating the target to two known temperatures permits calculation of the target emissivity using the radiances at each pixel in the two-dimensional field. An error is induced in the emissivity calculation by substituting the thermal-well temperature for the known target surface temperature. At the same time, the radiance image is distorted by two functions that affect the measurement accuracy. The precision of the instrument is altered by a random noise field function. The noise functions were investigated to determine whether they were added to or multiplied by the radiance equation. A plot of image-radiance means shows the same trends as the added noise functions suggested by the prediction. Correction of the induced distortions improved the accuracy noticeably. Further improvement in the accuracy is accomplished by using a syringe thermocouple to measure the actual surface temperatures used for the emissivity calculations. Investigation of the random noise field shows that it is zero-mean and Gaussian in nature. We can therefore average images over time to improve the precision. 9 refs., 12 figs., 1 tab.

37138 (LA-UR–89-1951) **The Los Alamos Fourier-transform spectrometer: Applications to molecular spectroscopy.** Palmer, B.A.; McDowell, R.S. Los Alamos National Lab., NM (USA). 1989. 6p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890674–3: 7. international conference on Fourier transform spectroscopy, Fairfax, VA, USA, 19-23 Jun 1989). Order

Number DE89014258/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

We outline design considerations and operating characteristics of the Los Alamos Fourier-transform spectrometer, a state-of-the-art instrument operating from 200 nm to 20 μm with a resolution of 0.0026 cm^{-1} and very high wave number and intensity accuracy. Recent work in molecular spectroscopy carried out with this instrument will be discussed, including N_2^+ spectra obtained in inductively-coupled plasmas; high-temperature spectra of diatomic molecules of astrophysical interest; high-resolution rovibrational fine structure; and Fourier-transform Raman spectroscopy of species in expansion-cooled gases. 8 refs., 5 figs., 4 tabs.

37139 (LA-UR-89-2148) **Detection of photon bursts from single 200 eV Mg ions: Progress in photon burst mass spectrometry.** Fairbank, W.M. Jr.; LaBelle, R.D.; Keller, R.A.; Chamberlin, E.P. Los Alamos National Lab., NM (USA). 1989. 4p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890618-1: 9. international conference on laser spectroscopy, Bretton Woods, NH, USA, 18-23 Jun 1989). Order Number DE89014289/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Modern atom counting methods, based on advances in laser and accelerator technology, provide a valuable complement to traditional decay counting methods for radioisotope dating and tracer work. Tandem Accelerator Mass Spectrometry (TAMS) has already had a large impact on ^{14}C dating and is beginning to provide new opportunities with ^{10}Be and several other isotopes. We report here on progress in the development of a laser-based technique, Photon Burst Mass Spectrometry, which is potentially capable of analyzing many of the elements which are forbidden in TAMS because they do not form negative ions. We are especially interested in the noble gases, which have a variety of potential scientific and environmental applications.

37140 (MLM-3593(OP)) **The effect of ultra-high vacuum on thermal ionization processes.** Tackett, J.R.; Ellefson, R.E.; Wiedenheft, C.J. EG and G Mound Applied Technologies, Miamisburg, OH (USA). 1989. 2p. Sponsored by DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-8905166-5: American Society for Mass Spectroscopy annual symposium, Miami Beach, Florida, USA, 22-26 May 1989). Order Number DE89014736/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have observed an annual delay in Pu and U ion production during a normal heating pattern when our triple-filament thermal-ionization source operates at a pressure less than 3×10^{-8} Torr. The data for this effect was obtained on a NBS-type 12"-90° sector mass spectrometer equipped with a 330 L/sec turbomolecular pump with a LN_2 trap for the source and a glass LN_2 cold finger directly above the ion source. The analyzer is ion pumped. When changing samples, the source is vented with dry N_2 (trapped with LN_2) to prevent accumulation of water vapor in the source. Additionally, the filament pins are vacuum baked as a final step in their cleanup process. This pumping system and the efforts to restrict water vapor from the source region reduced the source ion base pressure from 2×10^{-7} to 3×10^{-9} Torr after 8 months of the practice and the pressure during sample analysis was reduced to about 1×10^{-8} Torr. Pumpdown time was dramatically reduced reaching 5×10^{-8} Torr in 20 min of pumping after a sample change. As we approached these low pressures, we began to experience the delay effect and finally the enhanced ionization phenomena. 3 figs.

37141 (PNL-SA-16622) **Capillary zone electrophoresis-mass spectrometry of peptides and proteins.** Loo, J.A.; Udseth, H.R.; Smith, R.D. Pacific Northwest Lab., Richland, WA (USA). May 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-8905166-3: American Society for Mass Spectroscopy annual symposium, Miami Beach, FL, USA, 22-26 May 1989). Order Number DE89014466/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Capillary zone electrophoresis (CZE) is attracting extensive attention as a fast, high resolution analytical and micro-preparative separations technique for systems of biological interest. In zone electrophoresis, a column is filled with a single electrolyte having a specific conductivity. The mixture of substances to be separated is applied as a narrow band to the head of a buffer filled column in a band whose width is much less than the length of the column and at a concentration too low to affect the buffer conductivity. An electric field is then applied across the length of the column and the individual substances migrate and separate according to their net electrophoretic velocities. Zone electrophoresis carried out in small diameter (<100 μm) fused silica capillaries is a relatively new approach to the high resolution separation of aqueous samples. Very small volume samples (picoliter range) with separation efficiencies on the order of 10^6 theoretical plates for amino acids have been achieved. The method can be further enhanced by the dynamic combination of detection sensitivity and selectivity offered by mass spectrometry (MS). The on-line marriage of mass spectrometry to CZE is accomplished by an atmospheric pressure electrospray ionization source interface. Our research efforts have demonstrated that proteins with MW's greater than 100 kDa can be analyzed using a conventional quadrupole mass spectrometer with an upper m/z limit of only 1700. 6 refs.

37142 (PNL-SA-16629) **The on-line combination of capillary isotachophoresis with mass spectrometry.** Udseth, H.R.; Fields, S.M.; Loo, J.A.; Smith, R.D. Pacific Northwest Lab., Richland, WA (USA). May 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-8905166-4: American Society for Mass Spectroscopy annual symposium, Miami Beach, FL, USA, 22-26 May 1989). Order Number DE89014275/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Capillary zone electrophoresis (CZE) has been demonstrated to have tremendous potential for high-resolution separations of ionic compounds of biological interest. The small capillary diameter (<100 μm) used in CZE and the need to keep the ionic strength of the sample two orders of magnitude less than that of the buffer place rather stringent limits on the amount of sample that can be injected. Isotachophoresis in a capillary format (CITP) is a complementary scheme that overcomes these limitations (1). The CITP/MS combination has several attractive features. First, there are no fundamental limits on the sample size that can be introduced. Second, CITP can result in the concentration of samples that are injected in dilute solutions. Third, once the separation is developed the sample elutes continuously, allowing efficient use of detector time. Fourth, the ideal peak shape in CITP is sharp sided and flat topped. This is an ideal peak shape for mass spectrometric detection. The scan speed of most mass spectrometers is not challenged and MS/MS analysis is facilitated (2,3). Electrospray ionization (ESI) has been shown to be an effective means of ionizing labile biopolymers from solution. In this work we present the results of an examination of two systems using CITP coupled to mass spectrometry by an ESI interface of our design (2).

37143 (PNL-SA-16630) **Speculation on the mechanism(s) of electrospray ionization.** Smith, R.D.; Udseth, H.R.; Loo, J.A.; Edmonds, C.G.; Barinaga, C.J. Pacific Northwest Lab., Richland, WA (USA). May 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-8905166-2: American Society for Mass Spectroscopy annual symposium, Miami Beach, FL, USA, 22-26 May 1989). Order Number DE89014464/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Proteins can be effectively addressed by electrospray ionization (ESI), yielding a distribution of charge states. Reasonable mass spectra can be obtained with picomole quantities of protein, and the molecular weight of unknown substances can be accurately calculated based upon any two peaks (assuming one knows that the peaks are related). Given typical distributions the calculation is straightforward and the accuracy of the determination (generally 0.005 to 0.05% depending upon sample purity and S/N) is enhanced by use of several peaks. Simple mixtures may be readily addressed and the MW of each component determined.

37144 (SAND-88-3153) **The effects of snow on landmarks in K_u band SAR images.** Murray, M. Sandia National Labs., Albuquerque, NM (USA). Apr 1989. 117p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89014578/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report documents research into the effects of snow on candidate landmarks for the TFS radar. It includes a discussion of a simple snow model, relevant backscatter data from previous ground

based collections, predictions of the effects of snow coverage based on this data, a discussion of the snow data collection with the TFS radar, and an analysis of the results of that collection. All SAR images are for a K_u band radar, with HH polarization, and a 30° depression angle. The images have three meter resolution and a one kilometer swath. SAR images were collected of both rural and urban landmarks. 5 refs., 10 figs., 19 tabs.

37145 (SAND–89-0133C) **Droplet sizing calibration of the Phase Doppler Particle Analyzer.** O'Hern, T.J.; Rader, D.J.; Ceman, D.L. Sandia National Labs., Albuquerque, NM (USA). 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890737–2: ASME fluids engineering meeting, San Diego, California, USA, 9-12 Jul 1989). Order Number DE89008225/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Phase Doppler Particle Analyzer (PDPA) is an LDV-based instrument for simultaneous measurement of single particle size and velocity. A PDPA calibration was performed using well-characterized liquid droplets in the 4 to 80 μm diameter range. Two test liquids were used: oleic acid and kerosene. A standard PDPA instrument and a fiber-optic probe PDPA system were tested. The standard instrument measurements agreed with expected droplet diameters to within the droplet generation accuracy for droplets above 15 μm diameter, and had a measurement accuracy of about 2 μm for smaller droplets. The fiber-optic probe system exhibited similar behavior, although the 2 μm sizing uncertainty extended to droplets as large as 25 μm. The measurement uncertainties in the small diameter ranges are in qualitative agreement with the light-scattering computations of Al-Chalabi et al. (1988) and Saffman et al. (1984). 7 refs., 4 figs.

37146 (SAND–89-1192C) **A fully automated, single-connection tester for T/R modules.** Sloan, G.R.; Simons, J.M. Sandia National Labs., Albuquerque, NM (USA). 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8906132–1: Automatic RF Technologies Group meeting, Long Beach, CA, USA, 15 Jun 1989). Order Number DE89013155/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An inherent aspect of active array radars is the use of large numbers – typically hundreds – of transmit/receive (T/R) modules. The implementation of this technology at Sandia has created new challenges for the tester designer. Foremost among these challenges is the need to design T/R module testers which can accommodate such large numbers of devices-under-test (DUTs). This task is complicated by the fact that state-of-the-art T/R modules are extremely sophisticated and require a broad spectrum of tests for adequate evaluation. The Sandia T/R module operates in Ku band and consists of a transmitter, receiver, programmable phase shifter, programmable attenuator, modulator, switched limiter, and gate-array controller. The programmable phase shifter is common to both the transmitter and receiver, but the attenuator is unique to the receiver. The instruments required for the tests include a network analyzer, a spectrum analyzer, a noise figure meter, a peak-power meter, and an automated tuner system. The key to a successful tester is in integrating all of the above instruments such that the desired measurements can all be performed from a single, two-port, tester-to-DUT connection. The natural consequence of such a design is that some measurements will have to be de-embedded from the integrated test setup. This paper addresses both the tester's instrument integration and the resulting de-embedding concerns. 2 figs.

37147 (UCRL–100969) **A review of the development of a program to generate inspection programs for the OGP [Optical Gaging Products] optical CMM [Coordinate Measuring Machine].** Frank, R.N. Lawrence Livermore National Lab., CA (USA). 4 May 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8905150–1: NWW-CMM user group, Kansas City, MO, USA, 9-11 May 1989). Order Number DE89013774/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Due to software limitations of the Optical Gaging Products VIDI-COMP 200 Program, ANSI Y-14.5 profile analysis of mechanical parts being inspected on the OGP optical comparator is accomplished through direct actual/nominal comparison of discrete data points. On-line programming of complicated surfaces adequate to achieve statistically significant data density is extremely time consuming. The proprietary software requires over 45 keystrokes per data point to create a measurement program. Data quality is also circumspect when 12 decimal digits need to be calculated, read, and keyed in per x-y coordinate. In order to improve the efficiency of this process, I have written a program in Hewlett-Packard Basic 2.1 which generates a disk file which can be read as an OGP Part Program. The program prompts for input of basic information regarding the shape, size, and location of either an ellipse or parabola, and a measurement program is generated. This paper presents a view of the techniques used in working with the 32,000 lines of undocumented OGP code and the binary data files produced by the on-line programming functions to create a working program which can generate part program files in minutes, which would otherwise require days of effort.

45 EXPLOSIONS AND EXPLOSIVES

Refer also to citation(s) 37004, 37007, 37090, 37481, 37734

37148 (CONF-890769–2) **Explosives detection with an ion trap mass spectrometer.** McLuckey, S.A.; Glish, G.L.; Grant, B.C. Oak Ridge National Lab., TN (USA). 1989. 18p. Sponsored by DOE Defense Programs. DOE Contract AC05-84OR21400. From 3. international symposium on analysis and detection of explosives; Mannheim, Germany, F.R.; 10-13 Jul 1989. Order Number DE89012510/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

The combination of atmospheric sampling glow discharge ionization with mass spectrometry/mass spectrometry provides a powerful approach to the detection of trace quantities of explosives in air. The ion source is operated in such a way as to make it relatively immune to ionization interferences. False alarms are minimized by mass spectrometry/mass spectrometry, which has orders of magnitude greater informing power than other analyzers used in explosives detection. The ion trap mass spectrometer is a promising new device for mass spectrometry/mass spectrometry. A glow discharge ion source has been coupled to an ion trap. Even in its early stage of development it has proved superior to devices that employ more conventional approaches to mass spectrometry/mass spectrometry. Improvements in ion injection into the ion trap, however, are desirable (and are likely). 11 refs., 8 figs.

37149 (SAND–89-0677C) **Techniques for the detection of explosives.** Sandia National Labs., Albuquerque, NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890769–3: 3. international symposium on analysis and detection of explosives, Mannheim, Germany, F.R., 10-13 Jul 1989). Order Number DE89012570/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Novel methods/techniques for the detection of explosives are briefly described. The methods include vapor detection, preconcentrators, chemiluminescence detectors and microwave detectors. (CBS)

4501 Chemical

Refer also to citation(s) 36161, 37010, 37011, 37012, 37013, 37158

37150 (DOE/EH/79050–T1) **Hazards of explosives dusts.** Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center. 1989. 109p. Sponsored by DOE Environment Health & Safety. DOE Contract AI01-88EH79050. Order Number DE89014554/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The Bureau of Mines has investigated the hazards of military explosives dispersed as dust clouds in a 20-L test chamber. For purposes of personnel safety, the spark ignitability of the explosives in the form of unconfined dust layers was also studied. The 20-L data show that most of the explosives dusts were capable of sustaining explosions as dust clouds dispersed in air and some dusts were even capable of sustaining explosions when dispersed in nitrogen. The finest sizes of explosives dusts were less reactive than the larger sizes; this is opposite to the particle size effect observed previously for the pure fuel dusts. The data for the explosives dusts were compared to those for pure fuel dusts. 27 refs., 47 figs.

37151 (LA–11294-MS) **Numerical simulation of the simultaneous detonation of two identical, fully contained explosions.** Trent, B.C. Los Alamos National Lab., NM (USA). Jul 1989. 78p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE89014844/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

It has been proposed that a multiburst environment may have certain advantages over a single burst for driving a stress wave with given characteristics to a particular depth. This report describes a numerical study performed with the SHALE code to look at the simultaneous detonation of two fully contained, identical 500-kt bursts. Calculations are presented that show the distance a given peak stress is propagated in a low-porosity, saturated limestone and how this distance is enhanced if the stress waves from two bursts, with known separation, are allowed to interact. 5 refs., 49 figs.

37152 (MLM–3590) **Investigation of ambient and high temperature aging of PETN [pentaerythritol tetranitrate] by laser induced fluorescence and ultraviolet absorption spectroscopies.** Dosser, L.R.; Seliskar, C.J. EG and G Mound Applied Technologies, Miamisburg, OH (USA). 23 Jun 1989. 19p. Sponsored by DOE Defense Programs. DOE Contract AC04-88DP43495. Order Number DE89013740/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The chemical aging of pentaerythritol tetranitrate (PETN) has been and continues to be an important problem in producing and maintaining high energy compounds and components. The work done to date has identified several key concerns in evaluating the chemical and physical aging processes of PETN. These include the manner in which a particular type of PETN is prepared, the sample preparation procedure insofar as it can influence the adsorbed species on the solid PETN, and the methods of measurement and their influence on the quantitative determination on the gaseous decomposition products. In the work reported here, two noninvasive spectroscopic methods of measurement were chosen: laser induced fluorescence, which was used to monitor NO_2, and ultraviolet spectroscopy, which was used to monitor NO. A unique sample vessel design permitted both measurements to be made on the sample, and these two species could readily be measured in the presence of one another. Adsorbed NO_2, and its subsequent reaction to yield NO, was detected. Three types of PETN samples were aged at elevated temperatures, and varying amounts of NO and NO_2 were detected, depending on the sample and the method of preparation. The results indicate that an in situ experiment is necessary to further investigate PETN aging. 10 refs., 10 figs., 2 tabs.

37153 (UCRL–101058) **An architecture for real-time control and data acquisition at LLNL's high explosives application facility (HEAF).** Thompson, W.M.; O'Brien, D.W. Lawrence Livermore National Lab., CA (USA). May 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890545–4: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, Virginia, USA, 15-18 May 1989). Order Number DE89013051/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

HEAF is a new experimental facility for high explosive physics at LLNL. Experimental areas and diagnostics are briefly presented. Diagnostics range from digitized waveforms, to rotating mirror cameras, laser holography and velocimetry. The real-time control and data acquisition developed in the HEAF project is discussed in detail. Of particular interest is a computer architecture for support of independent experimental areas. Distributed supervisory control, safety related and time critical control are discussed. Operator consoles are briefly described. Hardware configurations are reviewed; software technologies and applications are presented. 7 refs., 3 figs.

4502 Nuclear

Refer also to citation(s) 36409, 36456, 36458, 36459, 36997, 37747

37154 (AD-A–955407/2/XAB) **Some aspects of Starfish.** Lowen, R.W.; Sowle, D.H.; Hamlin, D.A. General Dynamics Corp., San Diego, CA (USA). Convair Div. 20 Jun 1968. 17p. Available from NTIS, PC A03/MF A01.

Previous conjecture that certain puzzling observations of electromagnetic effects in the StarFish burst area could be understood as resulting from the effects of charge exchange is supported by further arguments and calculations. The conditions for copious charge exchange are discussed and shown to obtain for StarFish. Estimates are given for the velocity distribution of the escaping fast neutrals, for the pre-ionization they produce, and for the location of their first re-ionization. DAC-code results for piston location, attenuation, and radio-brightness temperature are presented. The energy spectrum and the number density of photoelectrons in the region of the debris expansion is calculated, based on an x-ray spectrum calculated by Longmire. Various problem areas in understanding Star-Fish are discussed, including the field-line jet, the stability of the bubble, and the deposition of the energy carried by the charge-exchange neutrals.

37155 (AD-A–955408/0/XAB) **Study of coupling in Starfish.** Longmire, C. Los Alamos Nuclear Corp., NM (USA). 30 Oct 1969. 51p. (LANC-R–5). Available from NTIS, PC A04/MF A01.

Some data from Starfish are examined with the goal of trying to discover the type of coupling that was effective between moving and stationary ions. It appears that Larmor-radius coupling is required, although there are some discrepancies, connected with the ambient air density or ionization cross sections, to be resolved.

37156 (CEA-CONF–9706) **Neutrons and gamma transport in atmosphere by Tripoli-2 code. Energy deposit and electron current time function.** Vergnaud, T.; Nimal, J.C.; Ulpat, J.P.; Faucheux, G. CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France). 1988. 35p. (In French). (CONF-880906–: 7. international conference on radiation shielding, Bournemouth, UK, 12-16 Sep 1988). Order Number DE89776471/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The Tripoli-2 computer code has been adapted to calculate, in addition to energy deposit in matter by neutrons (Kerma) the energy deposit by gamma produced in neutronic impacts and the induced recoil electron current. The energy deposit conduces at air ionization, consequently at a conductibility. This knowledge added at that of electron current permit to resolve the Maxwell equations of electromagnetic field. The study is realized for an atmospheric explosion 100 meters high. The calculations of energy deposit and electron current have been conducted as far as 2.5km.

37157 (SAND–89-0666) **Communication techniques for safely transmitting and verifying unique signals.** Cooper, J.A. Sandia National Labs., Albuquerque, NM (USA). Mar 1989. 49p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89013879/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A related function takes place in situations where an intermediate memory device may be used to store the unique signal information. In this case, "verification patterns" are communicated back to the source as status of the memory in which the unique signal is stored. If properly used, unique signals and verification patterns can support acceptable abnormal-environment nuclear detonation safety. If improperly used, there is danger of a false sense of complacency. In this report, the potential danger of misunderstanding the implications of abnormal environments is described. Unfortunately, a number of common normal-environment assumptions and analytical techniques are sometimes applied to abnormal environment situations. Several of these are shown to be misleading for assessing unique signal performance in abnormal environments. Misapplied approaches can encourage communication system design features that may seriously degrade nuclear detonation safety. 8 refs., 10 figs.

37158 (UCID–20622-89-1) **Chemistry and Materials Science research report: Weapons-Supporting Research and Departmental Institutional Research and Development: First half FY1989.** Lawrence Livermore National Lab., CA (USA). 1 Jun 1989. 102p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89014303/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The research reported here in summary form was conducted under the auspices of Weapons-Supporting Research (WSR) and Institutional Research and Development (IR and D). The period covered is the first half of FY89. Administratively, WSR is organized

into block-funded programs ("thrust areas") and a few smaller projects led by individual investigators. The results reported here are for work in progress; thus, they may be preliminary, fragmentary, or incomplete. Research on the following are briefly described: high-temperature superconductivity; tritium; interfaces, adhesion, and bonding; plutonium and actinides; high-explosives technology; fundamental mechanisms of metal processing; synchrotron-radiation-based materials science; enzyme mimics for methane conversion; structural characterization and modeling of organic aerogels; ultratrace analysis of explosive residues; site-specific chemistry using synchrotron radiation; electronic structure of systems with reduced symmetry; studies of thin molecular plasmas; and the structure-property link in subnanometer materials.

37159 (UCRL–21208) **Centrifuge tests on simulation of the "cookie cutter" mechanism of chimney collapse into underground openings: Final report.** Kutter, B.L.; Chang, Ging-Song. California Univ., Davis, CA (USA). Dept. of Civil Engineering. May 1989. 21p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89014100/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The underground testing of nuclear devices causes the formation of large underground cavities which eventually may be filled by rubble and soil falling from the roof of the cavity. The zone of collapsing soil progresses upward toward the ground surface to form a "chimney." The mechanisms of chimney collapse are important to understand for two important reasons. (1) A devastating and sudden propagation of the collapse may result in the formation of a surface crater which may threaten personnel and equipment in the vicinity of the crater. (2) Different collapse patterns are known to occur in the field and some of these collapse patterns are known to be associated with leakage of radioactive wastes to the ground surface. A number of centrifuge tests were conducted by Kutter et al. (1988), to study the collapse of cavities in uniform dry sands. In these materials, the chimney collapse patterns were found to involve continuous, smoothly varying shear strain patterns in the chimney. The pattern of collapse in one of the tests is shown in figure 1. Figure 1a shows the surface crater that formed on the ground surface due to the collapse of a 6 inch diameter cavity buried 18// beneath the ground surface. This result was obtained by draining fluid out of a 6// rubber bag while the centrifuge was spinning at 11 g.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

Refer also to citation(s) 37171

37160 (DFVLR-FB–89-06) **Investigation about the usefulness of Landsat 5 thematic mapper data for mapping forest disease.** Foerster, B. Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.); Technische Univ. Berlin (Germany, F.R.). Fachbereich Landschaftsentwicklung. 1989. 200p. (In German). Order Number DE89788359/JAW. Available from NTIS (US Sales Only), PC A09/MF A01.

The usefulness of Landsat 5 thematic mapper data for mapping forest disease in spruce stands (Picea abies) in the northern part of the Harz mountains, Germany, is investigated. In order to take the different illumination in this mountainous area into account, six illumination classes calculated from a Digital Terrain Model were used. The result of a detailed signature analysis showed, that the pixel-wise difference of the channels TM4-TM5 is best suited for an estimation of the quota of highly damaged spruce trees. The digital classification based on this difference is compared with the result of an aerial photo interpretation of the disease. (orig.) With 45 figs., 38 tabs., 79 refs.

37161 (UCID–21634) **Backgrounder contribution No. 18: Climate scenarios for the first UC/DOE workshop.** Knox, J.B. Lawrence Livermore National Lab., CA (USA). May 1989. 38p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. Order Number DE89014302/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this contribution is to provide a more detailed discussion of our workshop climate scenarios for the periods (1) 2000–2010 and (2) 2030–2070 summarized in the introduction. The description considers the rationale or method of preparation of each element in the climate scenarios, the associated references and source documents, and an estimate of the uncertainty associated with the elements of the scenarios. In addition, a description is included of the climate scenario presently being used in the State of California's Study of Global Warming, and supportive material in regard to the climate scenario used in the Australian assessment of global warming and its effects on that nation. The summary table of the two workshop climate scenarios is reproduced here in this chapter for ease of reference, with the scenario elements labelled alphabetically for discussion purposes. 95 refs., 5 figs.

5002 Chemicals Monitoring and Transport

Refer also to citation(s) 35594, 35897, 35964, 35965, 35966, 35967, 36349, 36438, 36449, 36720, 36866, 37204, 37393, 37394, 37397

37162 (AD-A–204737/1/XAB) **Indoor spatial monitoring of combustion-generated pollutants (TSP, CO, and BAP) by Indian cookstoves.** Menon, P. Hawaii Univ., Honolulu, HI (USA). Dept. of Meteorology. Jul 1988. 201p. (UHMET–88-01). Available from NTIS, PC A10/MF A01.

This dissertation focusses on indoor concentrations of pollutants (TSP, carbon monoxide and barium phosphide) emitted by Indian cookstoves. Experiments in a simulated village hut (SVH) determined size distribution of particulates from burning of fuelwood and cowdung, and investigated the effects of fuel, ventilation condition and sampling location on TSP, CO, and BaP concentrations; 84 to 99 % of the total particulate mass in wood and dung smoke had aerodynamic diameter less than 3.2 micro, which eliminated the need for particle-size discrimination sampling. These experiments finalized the field sampling protocol. The field survey included 291 households in three central and two south Indian villages. The kitchens had either thatched or tiled roofs with a variety of volumes and open spaces on the walls. Fixed monitoring was done at roof, medium, and low levels close to stove or chula (cemented to floor) and personal sampler on the cook-monitored air in her breathing zone.

37163 (BNL–42768) **Characterization of painted surfaces in the United States from the perspective of potential damage from acidic deposition.** Lipfert, F.W. Brookhaven National Lab., Upton, NY (USA). Mar 1989. 46p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE89014264/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Data on the types and applications of exterior paints used in the United States are reviewed from the perspective of potential damage by air pollution or acidic deposition. The data show that residential buildings are the most economically important subset of the painted structures in the US for painting costs. The trends for new construction suggest that this ranking is likely to continue in the future. Although both new construction and maintenance painting are economically important, the more difficult conditions involved in painting over existing finishes make this an important class of situations for research. Consumer surveys show that the most important mode of paint failure is peeling and flaking which, in its various manifestations, accounts for about half of residential paint problems. Such problems often occur within two to three years after painting. Color changes (deterioration) are next in importance. Although chalking and erosion have been observed their roles in decisions to repaint are less apparent. The trends in paint usage and performance are generally supportive of (or not inconsistent with) the hypothesis that air pollution or acid rain may be having some adverse effects, although such data are by no means conclusive. The report recommended that selections of coatings and substrate for acid deposition research include those combinations that are widely used (latex over wood and over previous paint) and those that are sensitive to acid deposition (paints containing $CaCO_3$; alkyd paint over steel). 38 refs., 28 figs., 5 tabs.

37164 (CONF-8905148–1) **Field studies for determining the characteristics and dynamics of local circulations.** Gudiksen, P.H.; Clements, W.E.; Hosker, R.P. Jr.; Whiteman, C.D.; Neff, W.D.; Coulter, R.L.; Start, G.E. Argonne National Lab., IL (USA). 1989. 39p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From 2. international workshop on real-time computing of the environmental consequences of an accidental release to the atmosphere from nuclear installations; Leuembourg, Netherlands; 16-19 May 1989. Order Number DE89013639/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The US Department of Energy sponsored Atmospheric Studies in Complex Terrain (ASCOT) program is designed to improve our understanding of the physical processes that govern pollutant dispersion in areas of complex terrain and to develop the technology needed to predict the air quality impact of pollutants released into terrain dominated flows. The focus of the program has been on the study of the characteristics of locally generated valley circulations with the primary emphasis being on evaluating the life-cycle of nocturnal cold air slope and valley flows. This phenomenon was selected on the basis of its importance for transporting pollutants from energy related facilities to population centers that are generally situated within valleys. The program's field studies component, which is closely integrated with the modeling activities, provides the data needed to evaluate the characteristics and dynamics of locally generated valley circulations. The Geysers geothermal area in northern California, situated within the coastal-mountain range, was chosen as the initial field studies area. Three series of major field experiments were performed in this area during the period from 1979 to 1981. 12 figs.

37165 (DOE/ER/60290–T2) **Trajectory analysis of nine years of precipitation chemistry in Charlottesville, Virginia: Final report.** Moody, J.L.; Galloway, J.N. Virginia Univ., Charlottesville, VA (USA). Dept. of Environmental Sciences. 6 Jun 1988. 109p. Sponsored by DOE Energy Research. DOE Contract FG05-85ER60290. Order Number DE89014532/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Precipitation has been collected in Charlottesville, Virginia, since 1976 as part of the Multi-State Air Pollution Power Production Study. Based on the chemical analyses of these precipitation events we know that Charlottesville regularly receives acidic precipitation. The average volume weighted hydrogen ion concentration is 54.8 umoles/liter, which corresponds to a pH of 4.3. The pH of natural uncontaminated precipitation is around 5.4, and since pH is measured on a logarithmic scale, this indicates that on the average, precipitation in western Virginia is at least ten times more acidic than normal. However, there is considerable variability in acidity, and indeed all the ion concentrations which contribute to acidity, from one precipitation event to the next. The basic scientific objective of this study was to learn to what degree this variability in concentration results from precipitation arriving from different source regions. To this end, we have used back trajectories to determine where air delivering precipitation to Charlottesville originated. The result is a climatology of transport for precipitation events over the nine year period from 1977–1985. 24 refs.

37166 (EC–1988, pp. 121-134) **Experiences in modelling water and land resources within a climate change framework.** Cohen, S.J. (Atmosphere Environment Service, Downsview, ON, Canada). Environment Canada, Ottawa, ON (Canada). 1988. (CONF-8611291–: Perspectives on land modelling, Toronto, Canada, 17-20 Nov 1986;MICROLOG–88-06350). In *Perspectives on land modelling. Workshop proceedings.* Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The purpose of this paper is to describe some recent modelling of impacts of future climatic change on water and land resources at the regional scale. The key element in this exercise is that climate is being considered as a variable, rather than a constant. In certain cases, such as water resources, existing models could already use climate data directly to perform the required calculations. A major obstacle to regional modelling is the mismatch of scales between global climate model resolution and the detail needed for such projects as net basin supply calculations for individual watersheds. This requires some interpolation of the climate model outputs, including the use of existing station data to provide a higher resolution projection of the greenhouse effect climate. Results of an interdisciplinary pilot study on the impacts of CO_2-induced climatic change on the province of Ontario are briefly presented. A scenario derived from a general circulation model developed by the Goddard Institute for Space Studies was used. Net basin supply and lake levels in the Great Lakes are projected to decrease. Impacts include losses in hydroelectric power production, shipping, skiing, and agriculture. However, there would be savings due to reduced demand for space heating, and gains in summer recreation. 24 refs., 2 figs., 3 tabs.

37167 (EC–1988, pp. 135-147) **Effects of climatic change on agricultural land resource potential.** Brklacich, M. (Univ. of Guelph, Guelph, ON, Canada); Smit, B. Environment Canada, Ottawa, ON (Canada). 1988. (CONF-8611291–: Perspectives on land modelling, Toronto, Canada, 17-20 Nov 1986;MICROLOG–88-06350). In *Perspectives on land modelling. Workshop proceedings.* Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This study estimates the extent to which a doubling in atmospheric CO_2 might affect food production opportunities throughout Ontario. It assesses the possible impacts of a CO_2 doubling on agroclimatic resources, crop productivity levels, and economic suitability of land resources for crop production. The analysis is facilitated by a land modelling system with which it is possible to evaluate implications of environmental (and other) changes on the distribution of land resources for food production. The specified changes in climate would imply a more favorable climate for crop production in the northern portions of Ontario. A wider array of crops could be grown and forage yields would increase. Production opportunities for crops currently grown in the southern parts of Ontario would be diminished. Overall, the specified changes in climate would reduce the biophysical prospects for crops currently grown in Ontario. 7 refs., 5 figs., 2 tabs.

37168 (EPS–3/UP/5) **National incinerator testing and evaluation program. Environmental characterization of mass burning incinerator technology at Quebec City. Summary report.** Environnement Canada, Ottawa, ON (Canada). Conservation et Protection. 1988. 111p. (MICROLOG–88-06241). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The environmental characterization of mass burning incinerator technology has been tested under a program whose objective was to define the optimum design and operating conditions to minimize emissions of concern. The facility tested is located in Quebec City, and was built in 1974. The furnace is of the waterwall type and the incinerator plant produces superheated steam for sale to a paper company. Five performance conditions were selected for extensive testing. All incoming wastes and ash residues were weighed, sampled, and analyzed. Key incinerator operating variables were monitored by an extensive computer network. A wide range of analyses was carried out on exhaust gas emissions and all the ash discharges. Under good operating conditions, dioxin emissions from the modified furnace were 40 to 100 times lower than for the original facility. Even under poor operating conditions, dioxins from the new furnace were an order of magnitude lower. A similar decrease in particulate emissions was observed. Significant multi-variate correlations were found between a number of trace organic emissions and operating variables such as combustion air flow rates, underfire/overfire ratio, and refuse feed rates. These variables were identified as potential control parameters that could be used to control incinerator operating conditions to ensure minimal trace organic emissions. In addition, strong correlations were identified between trace organic emissions and easily monitored variables such as carbon monoxide, excess oxygen, nitrogen oxides, and furnace temperature, which could be employed as early warning signals of high emissions. 14 refs., 35 figs., 26 tabs.

37169 (EPS–3/UP/5F) **National incinerator testing and evaluation program. Environmental characterization of mass burning incinerator technology at Quebec City. Summary report.** Environnement Canada, Ottawa, ON (Canada). Conservation et Protection. 1988. 125p. (In French). (MICROLOG–88-06240). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The environmental characterization of mass burning incinerator technology has been tested in Quebec City under a program whose main objective is to define the optimum design and operating conditions to minimize emissions of concern. The incinerator furnace tested is of the waterwall type and the incinerator plant produces steam for sale to a paper company. A new furnace design was evaluated during a three-month period. Five performance conditions were selected for extensive testing and all incoming wastes and ash residues were analyzed. Key operating variables were monitored by a computer network. A wide range of analyses was carried out on exhaust gas emissions and all the ash discharges. Under good operating conditions, dioxin emissions from the modified furnace were 40 to 100 times lower than for the original facility, achieving concentrations of 10 to 100 ng//Nm^3. Even under poor operating conditions, dioxins from the new furnace were an order of magnitude lower. A similar decrease in particulate emissions was observed. Significant multi-variate correlations were found between a number of trace organic emissions and operating variables such as combustion air flow rates, underfire/overfire ratio, and refuse feed rates. These variables were identified as potential control parameters that could be used to control incinerator operating conditions to ensure minimal trace organic emissions. In addition, strong multi-variate correlations were identified between trace organic emissions and easily monitored variables such as carbon monoxide, excess oxygen, nitrogen oxides, and furnace temperature, which could be employed as early warning signals of high trace organic emissions. 14 refs., 35 figs., 26 tabs.

37170 (ETDE-mf–9788269) **Ozone measurements near the ground and in the atmosphere in the first half-year 1988.** Deutscher Wetterdienst, Hohenspeissenberg (Germany, F.R.). Meteorologisches Observatorium. 1988. 180p. (In German). Order Number DE89788269/JAW. Available from NTIS (US Sales Only), PC A09/MF A01.

Sonderbeobachtungen des Meteorologischen Observatoriums Hohenpeissenberg.; no. 59.

Diagrams and tables, also for SO_2 in surface air.

37171 (Juel–2257) **Studies as to the measurement and the chemistry of formaldehyde and acetaldehyde in the lower troposphere.** Schubert, B.; Schmidt, U.; Ehhalt, D.H. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Atmosphaerische Chemie; Koeln Univ. (Germany, F.R.). Dec 1988. 205p. (In German). Order Number DE89788343/JAW. Available from NTIS (US Sales Only), PC A10/MF A01.

A method for determining formaldehyde mixing ratios in tropospheric air has been modified for the additional measurement of acetaldehyde. The technique is based on stripping of the aldehydes from the air into an aqueous 2,4-dinitrophenylhydrazine solution. The reaction products, the 2,4-dinitrophenzlhydrazones of the respective aldehydes, are separated using high performance liquid chromatography and quantified by UV absorption. In clean air, measurements can be performed with a time resolution of two hours. Formaldehyde and acetaldehyde mixing ratios were determined in continental air and over the Atlantic Ocean. In slightly polluted continental air, the mean mixing ratios of formaldehyde and acetaldehyde were 1.53 $\pm$ 0.76 ppb and 0.52 $\pm$ 0.61 ppb, much higher than the mean values of 0.41 $\pm$ 0.19 ppb for formaldehyde and 0.19 $\pm$ 0.13 ppb for acetaldehyde observed in marine air. Simultaneous measurements of ethene and propene concentrations showed a similar latitudinal distribution as formaldehyde mixing ratios, confirming the importance of alkenes for the aldehyde production predicted by models. The influence of nonmethane hydrocarbons is further indicated by the fact that the formaldehyde mixing ratios are correlated with the fact that the formaldehyde mixing ratios are correlated with the sum of the C_2-C_4 hydrocarbon concentrations in both, marine and continental air.

37172 (NRCC/IMR–28908) **Performance of sulfation and nitration plates used to monitor atmospheric pollutant deposition in a real environment.** Noel, D.; Hechler, J.; Roberge, H. National Research Council of Canada, Boucherville, PQ (Canada). Industrial Materials Research Inst. [1989]. 26p. (MICROLOG–89-00544). Available from Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Sulfation and nitration plates were exposed outdoors for various periods of time to evaluate their performance in a real environment. These passive monitors are used to estimate the deposition of pollutants on metallic surfaces, and thus to evaluate the influence of the atmosphere on the corrosion. Single-column ion chromatography was used to determine the quantity of anions absorbed on the plates. This technique is better than other analytical procedures such as turbidimetry or colorimetry because passive monitors exposed in an atmosphere with a low degree of pollution can be analyzed without preconcentration. However, the pH of the sample to be injected on the chromatographic column must be adjusted to between 6.0 and 12.0 in order to obtain reproducible sulfate values. For sulfation plates, the additivity of the deposition process is excellent for a period of exposure up to 3 months, with a reproducibility of about 2%. For nitration plates, the deposition process is not cumulative due to a physical change of the monitor during exposure. The correlation between the amounts of sulfate found on sulfation snd nitration plates was also examined. 16 refs., 6 figs., 5 tabs.

37173 (ORNL/CDIAC–25) **Estimates of CO_2 emissions from fossil fuel burning and cement manufacturing, based on the United Nations energy statistics and the US Bureau of Mines cement manufacturing data.** Marland, G.; Boden, T.A.; Griffin, R.C.; Huang, S.F.; Kanciruk, P.; Nelson, T.R. Oak Ridge National Lab., TN (USA). May 1989. 712p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. (NDP–030). Order Number DE89013739/JAW. Available from NTIS, PC A99/MF A01 - OSTI; GPO Dep.

This document presents global and national estimates of annual carbon dioxide (CO_2) emissions from fossil fuel burning and cement manufacturing for 1950–1986. These estimates are based on statistics from the Untied Nations and the US Bureau of Mines. These estimates and supporting data are available free-of-charge as a numeric data package (NDP) from the Carbon Dioxide Information Analysis Center. The NDP consists of this document and magnetic tapes containing machine-readable data files, a descriptive file, and computer codes to access the data files. This document summarizes the emission estimates in tabular and graphical form, describes the calculations, describes how the data were processed, defines limitations of the data and estimates, describes the information on the tapes, and provides reprints of pertinent literature. The CO_2 emission estimates show that the annual amount of CO_2 produced globally from fossil fuel burning and cement production has risen significantly since 1950. 18 refs., 3 figs., 16 tabs.

37174 (ORNL/FTR–2999) **[Workshop on global vegetation models, Laxenburg, Austria, 3 June–9 August 1988]: Foreign trip report.** Emanuel, W.R. Oak Ridge National Lab., TN (USA). 24 Aug 1988. 11p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014060/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The International Institute for Applied Systems Analysis (IIASA) is beginning the development of a global vegetation model. In April 1988, a major international workshop summarized and evaluated available concepts, data, and formalisms. An extended workshop during June and July reviewed findings of the April meeting and other background information. From this review, a framework for analyzing global vegetation dynamics and responses to environmental change was designed. A core plant growth module was derived and implemented.

37175 (ORNL/FTR–3009) **[Fifth international congress of plant pathology, Kyoto, Japan, August 23–27, 1988]: Foreign**

trip report. McLaughlin, S.B. Jr. Oak Ridge National Lab., TN (USA). 12 Sep 1988. 10p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014062/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler was invited to present two papers at Symposium XV of the Fifth International Congress of Plant Pathology. The major topics of the sessions within the symposium were (1) physiological and biochemical responses to air pollution, (2) air pollution-vegetation effects models, (3) joint action of multiple pollutants, and (4) acidic deposition. In the last session, the traveler presented two papers on the effects of air pollutants on forests. One described results of ongoing ORNL research on the physiological responses of red spruce to ambient pollution levels at high-elevation sites in the Great Smoky Mountains. The second provided an overview of the research being done in the Southern Commercial Forest Research Cooperative and used selected results from ORNL and other programs to illustrate results reported to date. Relevant information was obtained from several papers on mechanisms of action of chronic air pollution stress; this information may be useful in evaluating the mechanistic basis of pollutant impacts on forest trees. 20 refs.

37176 (ORNL/FTR–3047) **[European aerosol conference and workshop on aerosol deposition to natural surfaces, Lund, Goteborg, and Stockholm, Sweden, and Oslo, Norway, August 29–September 17, 1988]: Foreign trip report.** Lindberg, S.E. Oak Ridge National Lab., TN (USA). 28 Sep 1988. 15p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014061/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this trip was to (1) present a paper and chair a session on gas/particle interactions at the European Aerosol Conference (EAC) at the University of Lund, Sweden; (2) chair a working group and present a plenary lecture at the workshop of the Nordic Society for Aerosol Research (NOSA) on Aerosol Deposition to Natural Surfaces; (3) present seminars at the University of Stockholm and the Swedish Environmental Research Institute; (4) analyze data from the Integrated Forest Study research site at Nordmoen, Norway; and (5) present a plenary lecture at the NATO Advanced Research Workshop on Heavy Metals in the Atmosphere at the Norwegian Institute for Air Research. At the EAC, the traveler presented a paper titled "Aerosol Dry Deposition Estimates from a Throughfall Model." At the NOSA workshop, the traveler described a summary of recent applications of surface analysis methods to aerosol deposition in complex terrain. At the University of Stockholm and the Swedish Environmental Research Institute, the traveler presented seminars on recent results of the EPRI Integrated Forest Study on the Effects of Atmospheric Deposition. At the NATO workshop, the traveler presented a lecture titled "Behavior of Trace Metals in Forest Systems." 19 refs.

37177 (PB–89-164305/XAB) **User's guide to SDM- a Shoreline Dispersion Model.** PEI Associates, Inc., Cincinnati, OH (USA). Sep 1988. 225p. Available from NTIS, PC A10/MF A01.

The Shoreline Dispersion Model (SDM) is a multipoint Gaussian dispersion model that can be used to determine ground-level concentrations from tall stationary point sources that are influenced by the unique meteorological phenomena in a shoreline environment. The SDM model is a hybrid model that utilizes a shoreline fumigation model to determine the hours during the year when fumigation events are expected and that uses the EPA MPTER model to determine the remaining hours. The advantage of the SDM hybrid model is that it can provide the total impact of a source, i.e., the source itself and other nearby sources. This user's guide provides an overview of the program, its routines and algorithms, and describes the model input/output.

37178 (PB–89-164560/XAB) **HEGADAS: heavy gas dispersion program. User's guide.** Witlox, H.W.M.; Puttock, J.S.; Colenbrander, G.W. Shell Research Ltd., Chester (UK). Aug 1988. 105p. Available from NTIS, PC A06/MF A01.

For system on diskette, see PB–89-164552.

The HEGADAS program models the dispersion of releases of heavier-than-air gases to the atmosphere. The model is an integral model which uses assumed profile (e.g., concentration profile) shapes and empirical relations describing air entrainment. The model provides for a smooth transition to passive dispersion. Descriptions of heat transfer from the ground and water vapor transfer are also included. The source release rate may be constant or time-dependent (e.g., evaporating liquid pool).

37179 (PB–89-164651/XAB) **Preliminary survey report: control technology support for sensor, Unimin Corporation, Dividing Creek Sand Plant, Millville, New Jersey, August 16, 1988.** O'Brien, D.M.; Sheehy, J.W. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Dec 1988. 9p. (ECTB–171-12A). Available from NTIS, PC A02/MF A01.

A walk-through survey was conducted at the Dividing Creek Sand Plant, Millville, New Jersey as part of a study to determine the need for improving engineering controls in a sand-mining operation. Sand was dredged, sized, washed, purified of iron-containing impurities, dried, and loaded onto rail cars or trucks. A total of 24 hourly and nine salaried individuals were employed at this facility. In the processing facility the operator worked in an air-conditioned control room; and in the drying and loading areas, workers spent considerable time in air-conditioned sheds. Roof fans provided dilution ventilation in the processing plant. No local exhaust was used. In the drying facility air from the fluidized bed dryer was exhausted through a wet scrubber. A baghouse sitting atop one silo provided bin venting for the silos and exhaust for the final bucket elevator and the loading spouts. Processing areas were remarkably free of spilled sand. Safety shoes, glasses and hard hats were required in all areas. Respirators were required in designated areas. A safety brochure was mandatory reading for all personnel and visitors. Routine monitoring of silica exposure was performed twice yearly. Since this site is using ventilated loading spouts, not common in this industry, a comparison might be made between this method and more conventional techniques.

37180 (PB–89-165237/XAB) **Testing of hair dryers for asbestos emissions.** Geraci, C.L.; Baron, P.A.; Carter, J.W.; Smith, D.L. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Physical Sciences and Engineering. Sep 1979. 61p. Available from NTIS, PC A04/MF A01.

Portions of this document are not fully legible.

Tests were conducted on 30 hair dryers for the release of asbestos fibers into the effluent air to evaluate potential consumer exposure, for the Consumer Product Safety Commission. A hair-dryer test system was developed, consisting of a clean air source, a sampling duct assembly, several types of monitoring equipment and filter samplers. Generated samples were assessed by transmission electron microscopy capable of performing energy dispersive analysis of x rays and selected-area electron diffraction. Of the 30 dryers evaluated, 23 were home-use hand-held appliances, three were table-top hooded models, one was a hobby heat gun, and one was a heavy-duty commercial salon style dryer. The airborne asbestos concentrations generated by these dryers ranged from 0 to 0.11 structures/cm^3 and the mass concentrations ranged from 0 to 7652 nanograms/cm^3. No significant differences were noted whether the dryers were operated at high heat or at cycled heat.

37181 (PB–89-165922/XAB) **Evaluation of asbestos levels in two schools before and after asbestos removal. Final report.** Karaffa, M.A.; Chesson, J.; Russell, J. PEI Associates, Inc., Cincinnati, OH (USA). Mar 1989. 35p. Available from NTIS, PC A03/MF A01.

This report presents a statistical evaluation of airborne asbestos data collected at two schools before and after removal of asbestos-containing material (ACM). Although the monitoring data are not totally consistent with new Asbestos Hazard Emergency Response Act (AHERA) requirements and recent EPA guidelines, the study evaluates these historical data by standard statistical methods to determine if abated work areas meet proposed clearance criteria. The objectives of this statistical analysis were to compare (1) airborne asbestos levels indoors after removal with levels outdoors, (2) airborne asbestos levels before and after removal of asbestos, and (3) static sampling and aggressive sampling of airborne asbestos. The results of this evaluation indicated the following: the effect of asbestos removal on indoor air quality is unpredictable; the variability in fiber concentrations among different sampling sites within the same building indicates the need to treat different sites as

separate areas for the purpose of clearance; and aggressive sampling is appropriate for clearance testing because it captures more entrainable asbestos structures. Aggressive sampling lowers the chance of declaring a worksite clean when entrainable asbestos is still present.

37182 (PB–89-165997/XAB) **Health-hazard evaluation determination report No. 75-109, 110, 112, 114-274, Fairbanks Weighing Division, Colt Industries, St. Johnsbury, Vermont.** Rivera, R.O. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Apr 1976. 17p. (HHE–75-109-274). Available from NTIS, PC A03/MF A01.

Also includes HHE-75-112-274 and HHE-75-114-274.

A health-hazard evaluation investigation was conducted by NIOSH on July 28-31 and December 1-5, 1975 at the Fairbanks Weighing Division, Colt Industries, St. Johnsbury, Vermont, a facility engaged in the manufacturing of weighting scales. The survey regarding the presence of potential toxic concentrations of any of the substances found in the place of employment. Based on environmental sampling, ventilation measurements, observation of work practices and medical questionnaires it was established that, with one exception, all welders in the production welding area were exposed to toxic concentrations of welding fumes and gases. No health hazards were identified in the plating room, heat-treatment operation, and grinding, sanding, and abrasive cut-off area. Recommendations are made for improving the exhaust system to effectively remove welding fumes and gases.

37183 (PB–89-166227/XAB) **Health-hazard evaluation determination report No. 75-178-295, New York Telephone and Telegraph Company, 770 Broadway, New York, New York.** Kingsley, I. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Jun 1976. 7p. (HHE–75-178-295). Available from NTIS, PC A02/MF A01.

A health-hazard evaluation investigation was conducted by NIOSH on January 8, 1976 in a New York Telephone Company cable vault in New York City. The survey regarded worker exposure to styrene vapors while coating cable splices with polyester in telephone company cable vaults. Environmental sampling revealed that the workers were not exposed to hazardous airborne concentrations of styrene vapors. Routine operations were in progress at the time of this investigation, but the exposure may increase significantly during extended working periods. Therefore, recommendations are made to assure effective control under prolonged working hours.

37184 (PB–89-166235/XAB) **Health-hazard evaluation determination report No. 75-151-259, Winchester Hospital, Winchester, Massachusetts.** Levy, B.S.B. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Jan 1976. 17p. (HHE–75-151-259). Available from NTIS, PC A03/MF A01.

A health-hazard evaluation investigation was conducted by NIOSH on September 29-30 and October 1, 1975 at the Winchester Hospital in Winchester, Massachusetts to determine the concentrations of waste anesthetic gases and vapors to which operating-room personnel were being exposed. On the basis of environmental sampling, it was determined that concentrations of nitrous oxide measured in the operating rooms, greatly exceeded 30 ppm and that the concentrations of halothane were usually in excess of the 0.5 ppm level. The existing scavenging system absorbs the halothane vapors but not the nitrous oxide. Recommendations are made for effective control of both anesthetics.

37185 (PB–89-166243/XAB) **Health-hazard evaluation determination report No. 74-78-297, Amax Speciality Metals, Parkersburg, West Virginia.** Thoburn, T.W. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Jun 1976. 17p. (HHE–74-078-297). Available from NTIS, PC A03/MF A01.

A health-hazard evaluation investigation was conducted by NIOSH on July 16-19, 1974 at the Amax Speciality Metals, Parkersburg, West Virginia, a facility engaged in the production of nuclear-reactor-grade zirconium and hafnium from crude zirconium tetrachloride. Based on medical interviews and cutaneous examination of the exposed workers, personal observations made by NIOSH investigators, review of medical records and studies, and a review of the pertinent literature it was determined that a dermatitis problem and a respiratory irritancy problem existed in conjunction with the company's refining of zirconium and hafnium. In November 1974, zirconium operations were discontinued due to the inability to purchase or manufacture economically crude zirconium tetrachloride.

37186 (PB–89-166250/XAB) **Health-hazard evaluation determination report No. 73-185-256, Electromotive-Division, GMC (Plant 2), Chicago, Illinois.** Bloom, T.F. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Jan 1976. 28p. (HHE–73-185-56). Available from NTIS, PC A03/MF A01.

A health-hazard evaluation investigation was conducted by NIOSH on May 16, July 15-16, and October 15-16, 1974 and June 25, 1975 at the ElectroMotive Division, GMC, Plant 2, Chicago, Illinois, a manufacturer of diesel-locomotive components. The survey regarded lack of ventilation in the welding areas, which allegedly did not remove welding fumes. On the basis of the findings obtained in a random sample of workers, it was determined that some welders were exposed to concentrations of iron oxide fumes. Welders were not exposed to toxic concentrations of carbon monoxide, ozone and nitrogen dioxide. The presence of eye and respiratory irritation indicates that an irritant exposure takes place from a possible synergistic effect from the combination of irritant gases and particulates. The potentially toxic exposure to carbon dioxide in one area could have been responsible for the high incidence of headaches. No evidence of systemic toxicity was observed. Recommendations are made for improved environmental-control measures.

37187 (PB–89-167654/XAB) **Statistics on smoke and sulfur dioxide pollution in South Africa. Special report.** Walker, N.; Ellerbeck, R.; Marinus, N. National Physical Research Lab., Pretoria (South Africa). Atmospheric Sciences Div. Mar 1987. 79p. (CSIR-SR-ATMOS–87/13). Available from NTIS, PC EE06/MF E06.

Also pub. as National Physical Research Lab., Pretoria (South Africa). Atmospheric Sciences Div. rept. no. ISBN-07988-4025-0. See also PB–88-192091. North American Continent sales only.

The data collected during the period October 1984 to September 1986 via the National Survey of Smoke and Sulfur Dioxide are presented. Throughout the period monthly averages, monthly maxima, and seasonal and annual averages are given. For each operational site, the long- and short-term trends are presented, along with their respective statistical significance. Work associated with the operation of survey and results from research studies undertaken during the report period is summarized and presented. Recommendations for the future expansion of the project are given.

37188 (PB–89-168728/XAB) **Southern California Air Quality Study: fall study. Final report.** Appel, B.R.; Tokiwa, Y.; Povard, V. California Dept. of Health Services, Berkeley, CA (USA). Air and Industrial Hygiene Lab. Jul 1988. 79p. (CA/DOH/AIHL/SP–50). Available from NTIS, PC A05/MF A01.

See also PB–86-223427.

Atmospheric sampling was performed during the fall portion of the Southern California Air Quality Study (SCAQS), on six intensive study days in November - December 1987 at Long Beach Community College. The investigators measured nitrous, nitric, and hydrochloric acids, in addition to ammonia and nitrogen oxides. These species were sampled with annular denuders and a chemiluminescent NOx analyzer. Nitrogen dioxide measured by the NOx analyzer averaged about 13% higher than without denuders to remove interferents such as HNO_3 and HONO. HONO exhibited maxima between 0000 and 0600 hours, with 6-hour mean concentrations up to 14 ppb. Some evidence of artifactual HONO in the denuders was shown, however. HCL exhibited a diurnal maximum between 1000 and 1400 hours, with concentrations up to 15 ppb. HN_3 concentrations exhibited maxima during night or morning hours, with four or six hour averages up to 15 ppb.

37189 (PB–89-169833/XAB) **National Performance Audit Program; ambient air audits of analytical proficiency, 1987.** Parr, B.F.; Lampe, R.L.; Hunike, E.T.; Mitchell, W.J. Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Research and Exposure Assessment Lab. Jan 1989. 53p. (EPA–600/3-89/006). Available from NTIS, PC A04/MF A01.

See also PB–88-161542.

The report presents the results of the U.S. Environmental Protection Agency's 1987 National Ambient Air Audit Program by pollutant and by analytical method. Semiannual audits were conducted for

CO, Pb, NO_3 and SO_4 (filter strips) and acid rain, and an annual audit was conducted for particulate sampler flow rate. Continuous SO_2 monitors were audited throughout the year such that no monitor was audited more than once. Approximately 45 laboratories participated in each semiannual acid rain audit and in each NO_3 and SO_4 audit and approximately 90 laboratories participated in each Pb audit. Five hundred and ninety-five CO monitors, 262 SO_2 monitors, and 1333 high volume flow samplers were also audited. The results for each 1987 audit are presented in tabular form for each concentration level. The overall performance for all participants for each audit conducted since the beginning of the program is also illustrated in a series of figures.

37190 (PB–89-170716/XAB) **Release of dispersed asbestos fibres from soils.** Addison, J.; Davies, L.S.T.; Robertson, A.; Willey, R.J. Institute of Occupational Medicine, Edinburgh (UK). Sep 1988. 158p. (TM–88/14). Available from NTIS, PC EE08/MF E08.

Both natural and industrial asbestos contamination in soil on sites required for development can present health hazards if the soil is to be disturbed. Very little information is available about likely airborne asbestos fiber concentrations which might be encountered in working such a site or on the possible suppressant effects of water spraying during work. The study is aimed at providing some basic relevant information to these problems. Artificial mixtures were prepared using three different soil types (clay, sand and intermediate) with each of three asbestos types (chrysotile, amosite, and crocidolite) in concentrations of 1%, 0.1%, 0.01% and 0.001%, by weight. Airborne dust clouds were generated over periods of four hours from each mixture using a dust dispenser discharging into a 1.3 cu m test chamber. Airborne dust concentrations were measured for the full duration of the test using gravimetric dust sampling instruments and a sequence of membrane filter samples were collected for fiber counting by phase contrast optical microscopy.

37191 (PB–89-170724/XAB) **Further studies of respiratory health of wool textile workers. Final report, October 1986-July 1988.** Love, R.G.; Donaldson, K.; Cullen, R.T.; Smith, T.A.; Muirhead, M. Institute of Occupational Medicine, Edinburgh (UK). Oct 1988. 129p. (TM–88/16). Available from NTIS, PC EE07/MF E07.

Contents include: plan of study and layout of report; estimated risks of symptoms in wool textile workers in relation to inspirable-dust concentration; lung functional and chest radiographic effects of wool dust exposure in textile workers; ability of wool-dusts to cause pulmonary inflammation in rats, and immunological responses in mice; further characterization of respiratory illnesses related to wool mill dust.

37192 (PB–89-172274/XAB) **National Air Audit System FY 1986-1987 national report. Final report.** Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. Jan 1989. 144p. (EPA–450/2-89/003). Available from NTIS, PC A07/MF A01.

See also PB–86-169133.

The National Air Audit System (NAAS), which was developed jointly by EPA and representatives of State and local air-pollution-control agencies, was implemented for the first time in FY 1984, and audits were again conducted in FY 1985. The report for FY 1986-1987 indicates that State and local agencies generally have sound programs in each of the audited areas and the audited agencies show improvement over the previous audits. There are still areas where improvement is needed, however, and various remedial actions have been initiated. A task force is also being formed to assess how to improve the function of the NAAS, to make the audit results more comprehensive and useful.

37193 (PB–89-860910/XAB) **Electrostatic precipitators. January 1979-April 1989 (Citations from the NTIS data base). Report for January 1979-April 1989.** National Technical Information Service, Springfield, VA (USA). May 1989. 226p. Available from NTISPC N01/MF N01.

Supersedes PB–88-859053.

This bibliography contains citations concerning the utilization of electrostatic precipitators for air-pollution control in industrial plants and electrical power-generating facilities. Topics include theoretical analyses, field investigations of specific installations, and performance comparisons with other particulate removal systems. Economic evaluations and system design considerations are presented. (This updated bibliography contains 400 citations, 41 of which are new entries to the previous edition.)

37194 (PB–89-861017/XAB) **Atmospheric modeling of air pollution. September 1984-March 1988 (Citations from the NTIS data base). Report for September 1984-March 1988.** National Technical Information Service, Springfield, VA (USA). May 1989. 177p. Available from NTISPC N01/MF N01.

See also PB–89-861025.

This bibliography contains citations concerning the development, validation, and application of mathematical models for air-pollution studies of mobile and stationary pollution sources. The models cover a wide range of mathematical complexity, utilizing factors such as terrain features, wake effects, diffusion, atmospheric stability, atmospheric wind, precipitation scavenging, gravitational deposition, atmospheric photochemistry, and urban heat islands. The models are used to support environmental-impact studies and effects of proposed emission-control strategies. Excluded are models of stratospheric pollution behavior, as applied to high-flying aircraft. (This updated bibliography contains 352 citations, none of which are new entries to the previous edition.)

37195 (UCRL–53903) **Effects of trace gases on global atmospheric chemical and physical processes.** Kinnison, D.E. Lawrence Livermore National Lab., CA (USA). 26 May 1989. 262p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. Order Number DE89013887/JAW. Available from NTIS, PC A12/MF A01 - OSTI; GPO Dep.

Thesis. Submitted to Univ. of California, Berkeley.

This study examines the effects that increased emissions of anthropogenic and naturally-occurring trace gases have on the chemical and physical processes in the global temperature. The Lawrence Livermore National Laboratory (LLNL) one- and two-dimensional chemical-radiative-transport models of the troposphere and stratosphere, are used to calculate the net effects that variations in these trace gases, either individually, or taken together have on the ozone distribution and temperature structure. Using the LLNL one-dimensional model, calculation are made that include large changes of NO_x, Cl_x, and HO_x. The object was to see of any interesting or unexpected effects could be found. The nitrous oxide boundary value is varied from 1/4 to 8 times the reference (1960) value of 300 ppbv. Stratospheric Cl_x, is varied from 0 to 22 ppbv. Special atmospheres are considered in which all HO_x, NO_x, and Cl_x, or combinations of these are omitted from the reference atmosphere. A sensitivity study is carried out using the LLNL one- and two-dimensional chemical-radiative-transport models to examine possible effects of future aircraft NO_x emissions on stratospheric ozone. A broad range in magnitude, altitude, and latitude of the assumed NO_x emissions is examined for various background Cl_x values. The change in column-ozone is calculated for each sensitivity scenario relative to a reference atmosphere. 217 refs.

37196 (UCRL–99927-Rev.1) **Evaluating CFC [chlorofluorocarbon] alternatives from the atmospheric viewpoint: Revision 1.** Connell, P.S.; Wuebbles, D.J. Lawrence Livermore National Lab., CA (USA). May 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890692–13-Rev.1: 82. Air and Waste Management Association annual meeting and exhibition, Anaheim, California, USA, 25-30 Jun 1989). Order Number DE89014268/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Current understanding of atmospheric processes in the troposphere and stratosphere, in particular stratospheric ozone-controlling photochemistry, allows evaluation of the effects on the stratosphere of chlorine-containing compounds envisioned as CFC (chlorofluorocarbon) replacements prior to their production and release. Such evaluations can help to direct decisions on selecting CFC alternatives and define acceptable levels of production or emission. We employ a two-dimensional (latitude and altitude) computational representation of the troposphere and stratosphere which incorporates physical processes, e.g., species transport and radiative transfer, and homogeneous photochemical processes. Laboratory measurements of OH and $O(^1D)$ reactivity and spectral parameters of the alternative HCFC (hydrochlorofluorocarbon) compounds were used as input. The model-derived ozone depletion

potential (ODP) is a defined quantity relating the effect on ozone of emission of a species to the model-calculated effect of a standard compound, here CFC-11 ($CFCl_3$). Globally and annually averaged ozone depletion potentials vary from less than .02 to greater than 1.0 for various CFCs and HCFCs, primarily as a result of differences in calculated atmospheric lifetimes. Differences in stratospheric photochemistry among CFCs and HCFCs play a smaller but significant role. Zonally averaged ODPs for some compounds can range over a factor of three with latitude, however, as a result of differences in stratospheric lifetime and the altitude profile of Cl release in CFC or HCFC loss processes. While globally defined ODPs are useful in designing methods to reduce the overall stratospheric Cl burden and its impact on ozone, latitudinally and seasonally varying ODPs must be additionally considered as knowledge of specific areas of the impacts of decreasing ozone column abundance increases. 6 refs., 4 figs., 4 tabs.

37197 Errors in grab sample measurements of N_2O from combustion sources. Muzio, L.J. (Fossil Energy Research Corp., Laguna Hills, CA (USA)); Teague, M.E.; Kramlich, J.C.; Cole, J.A.; McCarthy, J.M.; Lyon, R.K. *JAPCA, International Journal of Air Pollution Control and Waste Management (USA)*, 39(3): 287-293 (Mar 1989). DOE Contract AC22-84PC70771.

An artifact in the use of grab sampling techniques for the measurement of N_2O emissions from fossil fuel combustion has been identified. Storing combustion products containing SO_2, NO_x and water for periods as short as two hours can lead to the formation of several hundred parts per million of N_2O where none originally existed. The amount of N_2O formed depends both on the amount of NO_x and SO_2 originally in the container. The experimental results are supported by a proposed chemical mechanism and kinetic calculations. An investigation of sampling protocols indicate that drying the gas to a 0°C dewpoint before introduction in the container reduces, but does not eliminate, N_2O formation. More complete drying may yield a valid sample although this approach has, as yet, not been evaluated. Valid grab samples can be obtained by either (1) removing the SO_2 before introducing the gas into the container; or (2) increasing the pH of the aqueous phase in the container with NaOH. The findings of this work has important consequences with respect to the role of combustion generated N_2O in the atmospheric N_2O balance, since much of the present data base has been obtained using grab sampling techniques.

5003 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 35785, 35786, 35833, 36195, 36196, 37229, 37747

37198 (CEA-DAS–561) **Test emission of uranium hexafluoride in atmosphere. Results interpretation.** Crabol, B. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete. Jan 1989. 14p. (In French). (CONF-8810351–: Meeting on uranium, Montpellier, France, 10-12 Oct 1988). Order Number DE89781564/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

To permit the modelization of gaseous uranium hexafluoride behaviour in atmosphere, a validation test has been executed the 10 April 1987. The experimental conditions, the main results and a comparison with a diffusion model are given in this report.

37199 (GAO/RCED–88-103) **Indoor radon.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1988. 63p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

Potentially hazardous levels of radon may be present in one out of every eight houses in the United States. One of the Environmental Protection Agency's major radon identification efforts has encountered delays, and its planned national assessment is still years from competition. Its initial tests of various mitigation techniques have demonstrated significant radon reductions but the techniques still need to be tested in a larger number of houses. Agencies which finance and insure civilian housing have radon activities ranging from responding to a few site-specific problems to not being involved with indoor radon issues at all. The limited involvement is due to the lack of a specific legislative mandate for an agency radon program. Courts have not addressed whether the federal government is required to compensate for or mitigate radon in housing when it acts as a seller, insurer, or landlord.

37200 (NUREG/CP–0098-Vol.1) **Proceedings of the 20th DOE/NRC nuclear air cleaning conference: Sessions 1–5.** First, M.W. (ed.). Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Harvard Univ., Boston, MA (USA). Harvard Air Cleaning Lab. May 1989. 627p. Sponsored by DOE/NE;NRC. (CONF-880815–Vol.1: 20. DOE/NRC nuclear air cleaning conference, Boston, Massachusetts, USA, 22-25 Aug 1988). Available from NTIS, PC A99/MF A01 - GPO - OSTI.

This document contains the papers and the associated discussions of the 20th DOE/NRC Nuclear Air Cleaning Conference. Major topics are (1) chemical processing systems, (2) reactor operations, (3) decommissioning and decontamination, (4) particulate filter developments, including filter testing and filter response to physical stress, (5) adsorption and testing of activated carbon and adsorber systems, (6) severe accident mitigation, (7) radon, (8) tritium, (9) monitoring and measurement systems, (10) the development of standards and regulations, and (11) concerns with existing standards and regulations.

37201 (NUREG/CP–0098-Vol.2) **Proceedings of the 20th DOE/NRC nuclear air cleaning conference: Sessions 6–15.** First, M.W. (ed.). Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Harvard Univ., Boston, MA (USA). Harvard Air Cleaning Lab. May 1989. 711p. Sponsored by DOE/NE;NRC. (CONF-880815–Vol.2: 20. DOE/NRC nuclear air cleaning conference, Boston, Massachusetts, USA, 22-25 Aug 1988). Available from NTIS, PC A99/MF A01 - GPO - OSTI.

This document contains the papers and the associated discussions of the 20th DOE/NRC Nuclear Air Cleaning Conference. Major topics are (1) chemical processing systems, (2) reactor operations, (3) decommissioning and decontamination, (4) particulate filter developments, including filter testing and filter response to physical stress, (5) adsorption and testing of activated carbon and adsorber systems, (6) severe accident mitigation, (7) radon, (8) tritium, (9) monitoring and measurement systems, (10) the development of standards and regulations, and (11) concerns with existing standards and regulations.

37202 (NUREG/CP–0098-Vol.3) **Proceedings of the 20th DOE/NRC nuclear air cleaning conference: An index to the 1st–20th AEC/ERDA/DOE and DOE/NRC nuclear air cleaning conferences.** Jennings, S.D. Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Oak Ridge National Lab., TN (USA). May 1989. 437p. Sponsored by DOE/NE;NRC. (CONF-880815–Vol.3: 20. DOE/NRC nuclear air cleaning conference, Boston, Massachusetts, USA, 22-25 Aug 1988). Available from NTIS, PC A19/MF A01 - GPO - OSTI.

This document contains a cumulative index to the first through twentieth AEC, ERDA, DOE, and DOE/NRC Nuclear Air Cleaning Conferences and incorporates corrections of errors appearing in prior intermediate indexes.

37203 (ORNL–6542) **Pasture grass interception and retention of ^{131}I, ^{7}Be, and insoluble microspheres deposited in rain.** Hoffman, F.O.; Frank, M.L.; Blaylock, B.G.; von Bernuth, R.D.; Deming, E.J.; Graham, R.V.; Mohrbacher, D.A.; Waters, A.E. Oak Ridge National Lab., TN (USA). May 1989. 150p. DOE Contract AC05-84OR21400. Order Number DE89014567/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Environmental Sciences Division Publication No. 3247.

During the summer of 1987, a series of field experiments was conducted for the National Cancer Institute to investigate the initial interception and postdeposition retention by pasture vegetation of soluble and insoluble forms of ^{131}I in rain. These experiments employed mechanical rain simulators to reproduce rain intensities ranging from 1.4 to 12.2 cm/h and droplet sizes of 1.7 and 2.5 mm. The tracers used in this study were ^{131}I as either iodide or periodate, $^{7}Be^{2+}$, and three size classes of radioactively labelled polystyrene microspheres (3, 9, and 25 μm in diameter). These materials were applied in simulated rain, in amounts varying from 1 to

30 mm, to pure stands of white clover and fescue and to mixed stands of old field vegetation. For either chemical form of ^{131}I, the fraction intercepted by vegetation over 5 cm tall decreased in almost direct proportion to the amount of rain. At low amounts of rain (1 to 2.5 mm) and high biomass (0.2 to 0. 3 kg_{dry}/m^2), the highest values of interception for ^{131}I ranged from 20 to 55%. At high amounts of rain (20 to 30 mm) and low values of biomass (0.05 to 0.12 kg_{dry}/m^2), the interception fraction decreased to about 0.6 to 2%. Unlike the results for ^{131}I, approximately 10 to 80% of the insoluble microspheres and soluble $^{7}Be^{2+}$ was intercepted by vegetation over 5 cm tall, with only minor differences attributed to the amount or intensity of rain. The most important variable for the vegetation interception of these substances was the amount of standing biomass. The effect of differences in vegetation type was minor compared to the combined influence of biomass and the amount and intensity of rain. 26 refs., 37 figs., 20 tabs.

37204 (WAPD-RC/E(EE)–451) **Effluent and environmental monitoring report for calendar year 1988.** Bettis Atomic Power Lab., West Mifflin, PA (USA). 1988. 78p. Sponsored by DOE Nuclear Energy. DOE Contract AC11-89PN38014. Order Number DE89013938/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The results of the radiological and non-radiological environmental monitoring programs for 1988 at the Bettis Laboratory are presented. The results obtained from the monitoring programs demonstrate that the existing procedures ensure that all environmental releases during 1988 were in accordance with applicable Federal and State regulations. Evaluation of the environmental data indicates that operation of the Laboratory continued to have no adverse effect on the quality of the environment. Furthermore, a conservative assessment of radiation exposure to the general public as a result of Laboratory operations demonstrated that the dose received by any member of the public was well below the most restrictive dose limits prescribed by the Environmental Protection Agency and the Department of Energy. 27 refs.

5006 Regulations

Refer also to citation(s) 37220

37205 (PB–89-138788/XAB) **Guidance for the preparation of quality-assurance plans for O_3/CO SIP (State Implementation Plan) emission inventories. Final report.** Kersteter, S.L.; Battye, R. Alliance Technologies Corp., Chapel Hill, NC (USA). Dec 1988. 61p. Available from NTIS, PC A04/MF A01.

This document presents guidance for the preparation of quality-assurance (QA) plans by State and local air pollution control agencies required under the post-1987 ozone and carbon monoxide State Implementation Plans. The guidance discusses both required and recommended components for these QA plans. Major topics that are covered are as follows: QA policy statement, QA and the project organization, planning, data collection and analysis, data handling, data reporting, and QA auditing.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

Refer also to citation(s) 35916, 35917, 35918, 35919, 35920, 35921, 36709, 37336, 37337, 37338

37206 (DOE/ER/60399–T2) **Ecophysiology and adaptation in desert shrubs: Final report.** Ehleringer, J.R. Utah Univ., Salt Lake City, UT (USA). Dept. of Biology. 1989. 13p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER60399. Order Number DE89014536/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the current funding period, we have focused on two main areas: (1) a consideration of the water sources used by plants, (2) a consideration of the role, extent and significance of twig photosynthesis in aridland species, and (3) studies of variation in carbon isotopic composition in plants as an indicator of water-use efficiency (ratio of photosynthesis to transpiration). Although not specifically a research project, a substantial amount of time was also spent organizing and editing "Stable Isotopes in Ecological Research," which was the result of a very successful, DOE-OHER sponsored symposium bringing together terrestrial and marine ecologists to discuss this topic for the first time. 14 refs., 6 figs., 2 tabs.

37207 (EGG–10617-2015) **The occurrence and status of candidate species listed by the US Fish and Wildlife Service on Naval Petroleum Reserve No. 1, Kern County, California.** EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations. Nov 1988. 62p. Sponsored by DOE Environment Health & Safety. DOE Contract AC08-88NV10617. Order Number DE89013926/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The distribution and status of four plant and nine animal species being considered by the US Fish and Wildlife Service (FWS) for protection under the Endangered Species Act and one animal species recently listed in the Act as endangered was determined for the Naval Petroleum Reserves in California (NPR-1 and 2). Hoover's woolly-star (Eriastrum hooveri), a Category 2 plant species, was located at 28 sites on NPR-1. The California jewelflower (Caulanthus californicus), Kern mallow (Eremalche kernensis), and San Joaquin woolly-threads (Lembertia congdonii) were not observed. Of these, the Kern mallow is most likely to occur based on habitat utilization and autecology. No evidence was gathered that suggests the Buena Vista Lake shrew (Sorex ornatus relictus) was present on either of the Reserves. Nelson's antelope ground squirrel (Ammospermophilus nelsoni) and the short-nosed kangaroo rat (Dipodomys nitratoides brevinasus) are both Category 2 mammals that were relatively abundant on NPR-1 and 2. The San Joaquin pocket mouse (Perognathus inornatus) was also captured on NPR-1 and 2, but was less numerous. The Tipton kangaroo rat (Dipodomys nitratoides nitratoides), a recently listed endangered species, was found in Section 23S of NPR-1 and Section 18H of NPR-2. No evidence was found that Morrison's blister beetle (Lytta morrisoni), Moestan blister beetle (Lytta moesta), Hopping's blister beetle (Lytta hoppingi), and the Molestan blister beetle (Lytta molesta) exist on either of the Reserves. Similarly, a survey conducted for the striped-skinned snail (Helminthoglypta callistoderma) found no evidence that the snail exists on either of the Reserves. No additional surveys for candidate species that were undetected are needed unless new evidence is collected that suggests the species are or may be present. 17 figs., 7 tabs.

37208 (INIS-BR–1539) **Contribution to origin of the reefs in northeastern.** Nobrega Coutinho, P. da; Farias, C.C. Sociedade Brasileira de Geologia, Recife, PE (Brazil). Nucleo do Nordeste. 1979. 5p. (In Portuguese). (CONF-7911203–: 9. symposium of geology in northeast, Natal, Brazil, Nov 1979). Order Number DE89619691/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Several reef lines parallel to the seashore are encountered on the heaches of north east Brazil, composing one of the most characteristic morphological phenomena of the region. The textural and mineralogical composition of the reefs is very similar to the sediments met in the submarine beach. The initial comentation seems to take place beach. X-ray diffraction analyses showed that the cement of the first reef line of the intertidal zone is constituited of 60% aragonite and of 40% magnesium calcite with approximately 15-18 mol. %$MgCO_3$ in the calcite. The cement of the second reef line in the submarine beach is made up of solely calcite with only 3 mol. %$MgCO_3$. This proportion becomes even smaller in the cement in the reefs beneath the sand bank. The cement of these reefs is a result of the dissolution and precipitation of organic fragments present in the submarine beach sediments, especial Halimeda. The composition of these fragments appeared to be identical to the reefs of the intertidal zone. The magnesium calcite is mainly a result to the alteration of the aragonite, being the marine inorganic precipitation as a secondary process.

37209 (INIS-BR–1540) **Mineralogical behavior of the phosphatic sedimentation in Pernambuco-Paraiba sedimentar coastal basin.** Albuquerque Menor, E. de; Amaral, A.J.R. do. Sociedade Brasileira de Geologia, Recife, PE (Brazil). Nucleo do

Nordeste. 1979. 12p. (In Portuguese). (CONF-7911203–: 9. symposium of geology in northeast, Natal, Brazil, Nov 1979). Order Number DE89619692/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This work reports the execution of the "Phosphate in the Sedimentary coastal zone of Pernambuco-Paraiba" Project, resulting from the execution of 35 drilling holes distributed between Paulista City, State of Pernambuco and the Miriri river valley, State of Paraiba. The rocks were analysed by X-ray diffraction, and the results were used in the working up of mineralogical logs. The mineralogical logs interpretation makes possible to distinguish phosphorite and sandy phosphorite areas inside a mineralization zone, wich laterally passes to a phosphatic carbonatic rocks area situated far from cost line of that epoch. Differences of the mineral paragenesis are used under a regional sedimentar model conception and indicated as prospecting guides. The dominance of Kaolinite is related to continental sediments (Beberibe Formation). The dominance of montmorillonite, on the other hand, is more to marine facies than to particular conditions of the phosphatic mineralization. The analysis of these conditions shows that the continental areas resistant to the pre-Maestrichtrian transegressive oscillations coincide to the more favourable places to the phosphatic mineralization.

37210 (INIS-BR–1541) **Mineralogy of bismutotantalite from Northeastern. Brazil.** Adusumilli, M.S. Sociedade Brasileira de Geologia, Recife, PE (Brazil). Nucleo do Nordeste. 1979. 10p. (In Portuguese). (CONF-7911203–: 9. symposium of geology in northeast, Natal, Brazil, Nov 1979). Order Number DE89619693/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Bismutotantalite samples were identified in the Carnauba dos Dantas pegmatites (State of Rio Grande do Norte). The study of the various species includes the optical characteristics and determination of X-ray fluorescence and diffraction whose results allowed to show the existence of ordered and disordered Bismutotantalites. The degree of "order-disorder" has been ascribed to the complex chemical composition and possible diadoch exchange between the Bi, $^{-}$Fe, $^{-}$Sn, $^{-}$Mn and Ta ions under influence of the varying physical and chemical conditions during the development of the pegmatite.

37211 Comparative analysis of broad-scale landscape patterns. Gardner, R.H. (Oak Ridge National Lab., Oak Ridge, TN (US)); Turner, M.G.; Milne, B.T.; O'Neill, R. *Bulletin of the Ecological Society of America (USA),* 68(3): 308 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

The effects of ecological processes on observed landscape patterns can be studied by using models which are neutral to the processes of interest. When USGS land use data (LUDA) were compared to data from neutral landscape models, significant differences in the number, size distribution of patches, and the area/perimeter (fractal) indices were found. Results have shown that landscape patterns are dependent on the scales at which they are measured. Therefore, it is critical to identify the appropriate scales and map resolution at which disturbance and landscape processes interact.

37212 The role of heterogeneity in structuring spatial hierarchies. O'Neill, R.V. (Environmental Sciences Div., Oak Ridge National Lab., Oak Ridge, TN (US)). *Bulletin of the Ecological Society of America (USA),* 68(3): 380 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

Following a paradigm based on Statistics and Newtonian physics, ecology often emphasizes the central tendency of observations and considers heterogeneity as extraneous noise. This approach ignores heterogeneity as an important measure of ecological systems. The present paper discusses two ways that heterogeneity characterizes the spatial hierarchies we observe on a landscape. As an exogenous factor, heterogeneity transforms a uniform landscape into a diverse array of habitats. Topography, moisture gradients, etc., create a spectrum of opportunities for species establishment. Heterogeneity compresses space, allowing a larger number of species to survive in a given area. As an endogenous factor, heterogeneity results from competition and natural selection acting to fill the available niches. In either case, heterogeneity is critical to understanding spatial hierarchies and community structure.

37213 Regeneration patterns in a southeastern floodplain forest. Sharitz, R.R. (Savannah River Ecology Lab., Aiken, SC (US)); Martin, N.E.; Schneider, R.L. *Bulletin of the Ecological Society of America (USA),* 68(3): 414 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

Hydrologic regime exerts a critical control on regeneration processes in floodplain wetlands. Community composition, seed rain, seedling establishment and survivorship patterns of woody species are compared in two bottomland hardwood communities along the same stream. These sites differ in flooding frequency and duration. Total species composition and numbers of seeds differed between the two sites over a two-year period. although seedling composition and densities also differed, first year survivorship for all species combined was high (70-80%) at both sites and not statistically different. However, of the two canopy dominants, intraspecific differences in survivorship between upstream and downstream sites were demonstrated by Liquidambar styraciflua (50 vs. 77%) but not by Acer rubrum (80 vs 74%). Seedling mortality patterns of most species were similar following winter, spring frost, summer flooding, and drought at both sites.

37214 Response of wetland herb communities to gradients of disturbance and substrate. Scott, M.L. (Savannah River Ecology Lab., Aiken, SC (US)); Dunn, C.P. *Bulletin of the Ecological Society of America (USA),* 68(3): 412 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

The effect of thermal disturbance and site characteristics on the distribution of herbs was studied in portions of a 3020 ha wetland in the southeastern U.S. Data were collected from four sites with different disturbance histories. Rank correlations between DCA ordination scores and site characteristics indicate that species composition differences among sites were associated with disturbance. Within site differences are related to water depth and substrate type. For all sites along the disturbance gradient, species richness is greatest on consolidated muck. Fewest species occur on loose muck at the most disturbed site (x-bar=1.9), whereas at the other two disturbed sites, logs support fewest species (x-bar=4.1 and 4.2). After 18 yrs of revegetation at a fourth site, vegetation patterns are moderately correlated with water depth (r=0.52). The authors' results fit such mechanistic concepts as the intermediate disturbance hypothesis and the subsidy-stress gradient.

5102 Chemicals Monitoring and Transport

Refer also to citation(s) 35662, 35796, 35814, 35924, 35964, 35965, 35966, 35967, 36434, 36439, 36440, 37190, 37204

37215 (CONF-8805296–1) **Report on Working Group deliberations: Water quality group.** Wesely, M.L. Argonne National Lab., IL (USA). 1988. 4p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From First regional workshop on integrated monitoring; New Brunswick, Canada; 31 May - 2 jun 1988. Order Number DE89013193/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Major effects on monitoring of water quality are currently active in transboundary areas that include the St. Croix River Basin, at the Kejimkujik Research Station in Nova Scotia, and in Atlantic coastal waters. A large number of agencies in Canada and the United States are involved in measurements of variables that range from water pH to bioaccumulation of toxic substances. At least five of the projects are considered long-term and continuous. Needs expressed most often by the Working Group were for greater accessibility by various user groups to data from multiple sources and more continuous monitoring efforts for toxic organic substances. Many of the Working Group members were particularly concerned with efficient use of available data for addressing problems as perceived by the public.

37216 (CONF-8905162–1) **Containment of organic leachates from leaking underground storage tanks using tailored soils as liners.** Peters, R.W.; Cadena, F.; Page, M.W. Argonne National Lab., IL (USA). 1989. 36p. Sponsored by Department of Defense.

DOE Contract W-31109-ENG-38. From Hazardous waste and environmental management in gas industry; Chicago, IL, USA; 1-2 May 1989. Order Number DE89013180/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The technical feasibility of using tailored soils for containment of hazardous organic pollutants has been demonstrated. The adsorptive properties of soils for benzene are dramatically improved using organophilic coatings. Tailoring of the soils results in a highly selective adsorbent, which have a great capacity to remove benzene, toluene, and xylene (BTX) compounds. All four soils studied showed significant adsorptive capacity improvement after tailoring with tetramethylammonium ions (TMA^+). The optimum TMA^+:CEC (cation exchange capacity) ratio was between 0.6 and 1.5. Soils tailored at TMA^+ doses as low as 50% of the CEC of the soil removed significant amounts of benzene from solution. pH plays a secondary role in the adsorption of benzene on the tailored soils. The capacities for benzene removal under dynamic column conditions were about 40–75% lower than those predicted from batch adsorption studies. The holdup of benzene increases with increasing clay content of the soils. The breakthrough curves for the pollutant movement through the soil columns can be predicted using conventional one-dimensional solute transport models. 28 refs., 10 figs., 4 tabs.

37217 (DOE/FC/10618–T1) **Ion exchange and soil attenuation of Gulf Coast and Great Plains soils: Final report.** Hassett, D.J.; Groenewold, G.H.; Stevenson, R.J.; Schmit, C.R.; Daly, D.J. North Dakota Univ., Grand Forks, ND (USA). Energy and Mineral Research Center. 15 Sep 1988. 100p. Sponsored by DOE Fossil Energy. DOE Contract AC21-84FC10618. Order Number DE89010850/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

There are many trace elements, including arsenic, selenium, and molybdenum, which can occur in significant concentrations in ash from low-rank coals. These elements have the potential to be leached from disposed ash and returned to the environment. As coal-waste leachates from disposal sites come into contact with surrounding sediments, these sediments can have a pronounced effect on concentrations of dissolved trace elements in the leachate. This project was designed to measure and characterize the trace element attenuation properties of overburden sediments from Texas, Montana, and Wyoming. The project began with a previous study of pH buffering and trace element attenuation properties of North Dakota sediments. The initial study provided much essential information and insight into possible mechanisms of trace element attenuation. In addition, this initial research provided us with an established experimental protocol with which to conduct studies on pH buffering and trace element attenuation properties of near surface overburden sediments. The samples used in this study were obtained from test holes drilled to a maximum depth of 100 feet. The resulting samples were evaluated with respect to their ability to buffer pH and attenuate trace elements using the techniques developed during the North Dakota phase of the project. 37 refs., 18 figs., 24 tabs.

37218 (EC–1988, pp. 89-99) **Acid rain and agricultural production in Ontario.** Ludlow, L. (Univ. of Guelph, Guelph, ON, Canada); Smit, B. Environment Canada, Ottawa, ON (Canada). 1988. (CONF-8611291–: Perspectives on land modelling, Toronto, Canada, 17-20 Nov 1986;MICROLOG–88-06350). In *Perspectives on land modelling. Workshop proceedings.* Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

An analytical framework was developed to assess the implications of environmental change for agriculture. In this framework, the degree to which acid rain distribution patterns may change, given an alternative future acid emission scenario, and the impacts of acid rain on crop yields, are estimated. Finally, the yield response estimates are included in a land model to assess the impacts of acid rain on regional agricultural production and production potential in Ontario. The scenario identified in this paper assumes that future acid emissions will decrease such that rain across Ontario becomes unpolluted by acids. Information derived from experiments and in the field are used to estimate the yield responses of selected crops if acid pollution was eliminated. Changes in regional production are then calculated for each county in southern Ontario by applying the yield response estimates to current land-use patterns of agricultural production. The implications of acid rain for production potential are determined using a model that maximizes the proportion by which current production levels can be exceeded. Results reveal that overall impacts of acid rain are relatively small. It is estimated that the province is incurring an annual loss of about $43 million (representing about 2%) due to acid rain. Although the impacts on total production are modest, it is shown that for some crops and regions the effects are more pronounced. The study illustrates the potential of models to assess the effects of changes in environmental conditions on the use of land resources from the local to the national scale. 20 refs., 3 figs., 2 tabs.

37219 (EC/IWD–IW/L-AR-WQB-88-143) **An application of SPANS technology to toxic contaminant monitoring in the Atlantic region.** O'Neill, H.J.; Hanna, W.B. Environment Canada, Ottawa, ON (Canada). Inland Waters Directorate. 1988. 53p. (MICROLOG–88-06352). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Two maps for Atlantic Canada were generated through the conjugation of land use, land capability, industrial location, and demographic databases. The Potential Sources of Pesticides map illustrates the potential sources of agricultural pesticides, while the Potential Sources of Toxics maps illustrates known agricultural, industrial, and population factors. A relative scale ranging from very high to low was employed to rank contaminant potential on a regional scale. An areal analysis of this map indicates that approximately 10% of the region fell into the very high and high categories. An examination of empirical data confirms the general accuracy of this map. Of the 55 observations of toxic contaminants (polycyclic aromatic hydrocarbons, including fluoranthene, DDT, and PCB) ranked high and very high, 78% (43) are located in areas ranked high and very high on the hypothesis map. Additionally, a strong correlation between potential pesticide input and nutrient levels supports the validity of the hypothesis map. Monitoring networks for individual toxic contaminants may be enhanced by following the approach of this study. The occurrence of a toxic chemical in the environment is a function of many factors, but by converting information relevant to a specific toxin (contributing industries, soil types, etc.) into maps and conjugating the maps together via matrix overlays, accurate predictive maps may be created. 12 refs., 12 figs., 5 tabs.

37220 (ORNL–6526/R4) **Environmental Regulatory Update Table, May 1989.** Houlberg, L.M.; Langston, M.E.; Nikbakht, A.; Salk, M.S. Oak Ridge National Lab., TN (USA). Jun 1989. 100p. Sponsored by DOE Environment Health & Safety. DOE Contract AC05-84OR21400. Order Number DE89014569/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Environmental Sciences Division Publication No. 3248.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and projection of further action.

37221 (PB–89-166359/XAB) **Use of industrial-hygiene samplers for soil-gas measurement.** Kerfoot, H.B.; Mayer, C.L. Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV (USA). Mar 1989. 36p. Available from NTIS, PC A03/MF A01.

This report describes a field evaluation of a passive-sampling technique for soil-gas surveying. The system uses a sampler, consisting of an industrial hygiene organic vapor monitor inside a metal-sampling manifold, buried at a depth of approximately 0.3 meters (1 foot). An absorbent sampler is buried at a shallow depth and allowed to collect VOCs from the soil atmosphere. After a set time (8 hours to several weeks), the sampler is retrieved, sealed immediately, and transported to a laboratory for analysis. Analysis

results indicate the identity and concentration of VOCs collected by the sampler. The main advantage of passive sampling lies in the simplicity of field operations, that is, field support (supplies, personnel, and equipment) is much less costly than for grab sampling, and equipment problems are virtually non-existent. The disadvantages associated with passive sampling are that results are not available for days to weeks and that deep sampling is difficult without more elaborate equipment.

37222 (PB–89-167365/XAB) **Drum centrifuge modelling of long-term pollutant migration through a soil layer.** Edwards, R.I. Cambridge Univ. (UK). Dept. of Engineering. 1988. 46p. (CUED/D-SOILS/TR–220). Available from NTIS, PC EE05/MF E05.

With the advent of the awareness of potential problems associated with land based waste-repository configurations, studies have been conducted to examine some of the site processes involved. These include the processes by which leachate pollutants migrate away from these disposal sites, with the subsequent contamination of the ground-water system. Studies employing accelerated physical modelling have been undertaken incorporating both the drum and beam centrifuge systems. These have to date been conducted over relatively short (30-100 years) prototype migration times, a drum centrifuge test was therefore conceived which by utilizing the full area of the drum wall, would allow the study of pollutant transport over a wide range of conditions.

37223 (PNL-SA–16782) **The need for control agencies to update today's conceptual basis for groundwater quality requirements and subsurface evaluation guidelines.** Nelson, R.W. Pacific Northwest Lab., Richland, WA (USA). May 1989. 11p. Sponsored by DOE Defense Programs. DOE Contract AC06-76RL01830. (CONF-890397–2: New field measurements conference, Dallas, Texas, USA, 20 Mar 1989). Order Number DE89014453/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper proposes that: (1) the implicit assumptions forming the conceptual basis of today's subsurface water quality control requirements and evaluation guidelines are too simple, (2) such unrealistic simplicity means the present conceptual basis is incomplete, (3) the bottom-line result is incomplete, which leads to poor quality technical evaluations. Also, because of the simplified and incomplete conceptual basis, there are a continuing proliferation of control regulations and an ever growing stream of more complicated guidelines. Each guideline inacted to clarify the earlier flawed position. Such a Band-Aid over Band-Aid upon Band-Aid approach for covering the incomplete and too simplistic basis is doomed from the outset. The real solution lies in changing the incomplete basis and starting afresh with realistic regulations and key meaningful fundamental technical guidelines. 2 refs.

5103 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 35785, 35786, 36196, 37204, 37278

37224 (AERE-R–12978) **Sorption of radionuclides on London clay.** Berry, J.A.; Bourke, P.J.; Green, A.; Littleboy, A.K. UKAEA Harwell Lab. (UK). Chemistry Div. Feb 1989. 36p. Available from H.M. Stationery Office, London, price Pound 10.00.

Techniques for studying the sorption of radionuclides on London clay have been investigated. This work involved the use of through-diffusion, in-diffusion, high-pressure convection and batch methods to study the sorption of iodide, strontium, caesium and americium. Through-diffusion and high-pressure convection methods were found to be most useful for investigating weakly and moderately sorbing nuclides and give realistic values for sorptivity. The batch technique remains the most practical method of obtaining large quantities of data within a relatively short timescale but gives very high sorptivity values. It is however very useful for intercomparisons of nuclides or geological media. The in-diffusion method requires further refinement for use with strongly sorbing nuclides. Good agreement between through-diffusion and high-pressure convection methods was obtained for the sorptivity of strontium, whilst trends observed for caesium by through-diffusion were confirmed by batch measurements.

37225 (CFFTP-G–87004) **Field studies of HT oxidation and dispersion in the environment. I. The 1986 August experiment at Chalk River.** Brown, R.M.; Ogram, G.L.; Spencer, F.S. Canadian Fusion Fuels Technology Project, Toronto, ON (Canada). Jan 1987. 81p. Order Number DE89619866/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

The environmental dispersion and oxidation of a controlled atmospheric release of tritiated hydrogen (HT) was studied in a pilot-scale field experiment. This study was designed to test procedures and obtain preliminary results for planning a more intensive experiment to determine the environmental behaviour of HT with emphasis on the processes leading to the appearance of HTO in the atmosphere, ie., conversion, deposition and resuspension. Field observations led to the following conclusions: (1) no evidence was found for the rapid conversion of HT to HTO in the atmosphere, (2) observations support the hypothesis that the dominant process giving rise to the observed HTO in air was HT oxidation in the soil by microbial action followed by resuspension of HTO, (3) HT deposition velocities to soil ranged between 0.041 cm/s and 0.13 cm/s, consistent with previous chamber measurements, (4) the rate of HTO loss from soil, averaged over 21 days, was less than 1% per hour, and (5) vegetation HTO concentrations initially increased with time then by 48 hours decreased exponentially at a rate similar to soils. These results will be validated and extended by the intensive experiment scheduled for June, 1987.

37226 (CONF-890207–34) **Implementation of an integrated CERCLA-NEPA environmental process at a FUSRAP site.** Devgun, J.S.; Beskid, N.J.; Robertson, R.C.; Atkin, R.G. Argonne National Lab., IL (USA). 1989. 11p. Sponsored by DOE Environment Health & Safety. DOE Contract W-31109-ENG-38. From Waste management '89; Tucson, Arizona, USA; 26 Feb - 2 mar 1989. Order Number DE89013650/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and its amendment in 1986 through the Superfund Amendments and Reauthorization Act (SARA) have significantly affected the environmental compliance process. Remedial actions at contaminated sites now must satisfy the requirements of not only the National Environmental Policy Act (NEPA) but also CERCLA, as amended. For planning and conducting remedial actions under the Formerly Utilized Sites Remedial Action Program (FUSRAP), the US Department of Energy has developed and implemented an integrated process aimed at satisfying the requirements of both NEPA and CERCLA, as amended. The integrated approach involves a single, comprehensive environmental process that results in a single set of documentation. The process is streamlined, efficient, and cost effective and it minimizes confusion to the public. This paper discusses the need for, and the elements of, the integrated process as applied to FUSRAP sites. The implementation of the process is illustrated through a case study of FUSRAP sites in Tonawanda, New York. 5 figs.

37227 (DOE/OR/21400–T371) **Impacts of DOE Order 5820.2A on Oak Ridge National Laboratory.** Robinson, S.M. Oak Ridge National Lab., TN (USA). 1989. 12p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89010175/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Department of Energy (DOE) is responsible for promulgating regulations, guidelines, and performance standards relative to the operations of DOE facilities. DOE establishes orders and guidelines for the conduct of operations at contractor-operated sites which manage radioactive, hazardous, and mixed waste. These sites are regulated through DOE Orders which are written, implemented, and enforced through DOE Headquarters in Washington, DC. In addition, DOE sets the policy for complying with applicable public laws. Waste management activities in general have been subjected to increased scrutiny over the past eight years. Federal and state laws and regulations covering all aspects of hazardous and radioactive waste management have been promulgated. As state and federal regulations have become increasingly strict, DOE sites have been exempt from the restrictions imposed on their neighboring industrial plants. In addition, the news media has begun to focus on DOE's past waste management practices which have led to environmental

contamination problems at various sites throughout the United States. As a result, DOE has received criticism for the manner in which it regulates its own waste and environmental management activities. Meanwhile, technical advancements have been made to allow more effective waste treatment and isolation from the environment. These criticisms and technical advancements have prompted DOE to pass several new orders containing much stricter requirements for waste handling, treatment, and disposal.

37228 (NUREG–0837-Vol.9-No.1) **NRC TLD [thermoluminescent dosimeter] Direct Radiation Monitoring Network: Progress report, January–March 1989.** Struckmeyer, R.; McNamara, N. Nuclear Regulatory Commission, King of Prussia, PA (USA). Region I. Jun 1989. 222p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A10/MF A01 - GPO - OSTI.

The US Nuclear Regulatory Commission (NRC) Direct Radiation Monitoring Network is operated by the NRC in cooperation with participating states to provide continuous measurement of the ambient radiation levels around licensed NRC facilities, primarily power reactors. Ambient radiation levels result from naturally occurring radionuclides present in the soil, cosmic radiation constantly bombarding the earth from outer space, and the contribution, if any, from the monitored facilities and other man-made sources. The Network is intended to measure radiation levels during routine facility operations and to establish background radiation levels used to assess the radiological impact of an unusual condition, such as an accident. This report presents the radiation levels measured around all facilities in the Network for the first quarter of 1989. A complete listing of the site facilities monitored is included. In some instances, two power reactor facilities are monitored by the same set of dosimeters. All radiation measurements are made using small, passive detectors called thermoluminescent dosimeters (TLDs), which provide a quantitative measurement of the radiation levels in the area in which they are placed. Each site is monitored by arranging approximately 40 to 50 TLD stations in two concentric rings extending to about five miles from the facility. All TLD stations are outside the site boundary of the facility.

37229 (TVA/PUB–88/19) **Annual radiological environmental monitoring report, Watts Bar Nuclear Plant.** Tennessee Valley Authority, Chattanooga, TN (USA). Radiological Control. May 1988. 117p. Sponsored by Tennessee Valley Authority. Order Number DE89014206/JAW. Available from NTIS, PC A06/MF A01 - OSTI.

This report describes the preoperational environmental radiological monitoring program conducted by TVA in the vicinity of the Watts Bar Nuclear Plant (WBN) in 1988. The program includes the collection of samples from the environment and the determination of the concentrations of radioactive materials in the samples. Samples are taken from stations in the general area of the plant and from areas that will not be influenced by plant operations. Station locations are selected after careful consideration of the weather patterns and projected radiation doses to the various areas around the plant. Material sampled includes air, water, milk, foods, vegetation, soil, fish, sediment, and direct radiation levels. During plant operations, results from stations near the plant will be compared with concentrations from control stations and with preoperational measurements to determine potential impacts to the public. The exposures calculated from environmental samples were contributed by naturally occurring radioactive materials, from materials commonly found in the environment as a result of atmospheric fallout, or from the operation of other nuclear facilities in the area. Since WBN has not operated, there has been no contribution of radioactivity from the plant to the environment. 4 refs., 2 figs., 1 tab.

37230 (TVA/PUB–88/20) **Annual radiological environmental operating report, Sequoyah Nuclear Plant, 1988.** Tennessee Valley Authority, Chattanooga, TN (USA). Radiological Control. Apr 1989. 114p. Sponsored by Tennessee Valley Authority. Order Number DE89014207/JAW. Available from NTIS, PC A06/MF A01 - OSTI.

This report describes the environmental radiological monitoring program conducted by TVA in the vicinity of the Sequoyah Nuclear Plant in 1988. The program includes the collection of samples from the environment and the determination of the concentrations of radioactive materials in the samples. Samples are taken from stations in the general area of the plant and from areas not influenced by plant operations. Station locations are selected after careful consideration of the weather patterns and projected radiation doses to the various areas around the plant. Material sampled includes air, water, milk, foods, vegetation, soil, fish, sediment, and direct radiation levels. Results from stations near the plant are compared with concentrations from control stations and with preoperational measurements to determine potential impacts of plant operations. The vast majority of the exposures calculated from environmental samples were contributed by naturally occurring radioactive materials or from materials commonly found in the environment as a result of atmospheric nuclear weapons fallout. Small amounts of Co-60 were found in sediment samples downstream from the plant. This activity in stream sediment would result in no measurable increase over background in the dose to the general public. 4 refs., 2 figs., 2 tabs.

37231 (TVA/PUB–88/21) **Annual radiological environmental operating report, Browns Ferry Nuclear Plant, 1988.** Tennessee Valley Authority, Chattanooga, TN (USA). Radiological Control. Apr 1989. 126p. Sponsored by Tennessee Valley Authority. Order Number DE89014208/JAW. Available from NTIS, PC A07/MF A01 - OSTI.

This report describes the environmental radiological monitoring program conducted by TVA in the vicinity of Browns Ferry Nuclear Plant in 1988. The program includes the collection of samples from the environment and the determination of the concentrations of radioactive materials in the samples. Samples are taken from stations in the general area of the plant and from areas not influenced by plant operations. Station locations are selected after careful consideration of the weather patterns and projected radiation doses to the various areas around the plant. Material sampled includes air, water, milk, foods, vegetation, soil, fish, sediment, and direct radiation levels. Results from stations near the plant are compared with concentrations from control stations and with preoperational measurements to determine potential impacts of plant operations. The vast majority of the exposures calculated from environmental samples were contributed by naturally occurring radioactive materials or from materials commonly found in the environment as a result of atmospheric nuclear weapons fallout. Small amounts of Co-60 were found in sediment samples downstream from the plant. This activity in stream sediment would result in no measurable increase over background in the dose to the general public. 3 refs., 2 figs., 2 tabs.

37232 (TVA/PUB–88/22) **Environmental radioactivity levels Bellefonte Nuclear Plant: Annual report, 1988.** Tennessee Valley Authority, Chattanooga, TN (USA). Radiological Control. [1989]. 31p. Sponsored by Tennessee Valley Authority. Order Number DE89014209/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

The Bellefonte Nuclear Plant (BLN), being constructed by the Tennessee Valley Authority (TVA), is located in Jackson County, Alabama, on a peninsula bounded on the west by Town Creek embayment and on the east by Guntersville Reservoir at Tennessee River Mile (TRM) 391.5. The site is approximately 6 miles (10 kilometers) northeast of Scottsboro, Alabama. The plant will consist of two pressurized water reactors; each unit is rated at 3620 MWt and 1271 MWe. Fuel load in Unit 1 has not been scheduled. A preoperational environmental radiological monitoring program was implemented in August 1978 and continued through 1983. This program had the objective of establishing a baseline of data on the distribution of natural and manmade radioactivity in the environment near the plant site. Because of the extended delay in fuel loading, the sampling program was substantially reduced for 1984, 1985, and 1986. This reduced program was discontinued in the fall of 1988. The full preoperational sampling program will be restarted approximately 1 year prior to fuel loading. This report presents the results obtained from the program conducted during 1988. 16 figs., 10 tabs.

37233 Absorption, distribution, and fate of neptunium in plants. Cataldo, D.A. (Pacific Northwest Laboratory, Richland, WA (USA)); Garland, T.R.; Wildung, R.E. *Journal of Agricultural and Food Chemistry (USA)*, 36(3): 657-662 (May-Jun 1988). DOE Contract AC06-76RL01830.

Soil-plant concentration ratios (CR) for neptunium (Np) in bushbean, measured over the range of 5.2×10^{-7} to 4.1 mg of Np/g of soil, are approximately 2 at soil concentrations below 4×10^{-4} mg/

g and increase to 12 at higher soil levels. The CR values determined for soybean, bushbean, barley, and alfalfa range from 0.5 to 4 at a soil concentration of 2.6×10^{-6} mg/g. Root absorption by soybean seedlings of Np from solutions containing 7×10^{-7} to 473 mg of Np(V)/mL is generally proportional to concentration but exhibits some saturation in root absorption at higher concentrations. Seed concentrations in bushbean and wheat are a factor of 10 lower than vegetative tissues. Neptunium is transported within the plant in organic complexes containing one or more organic acid residues. Fractionation of plant tissues indicates that Np is substantially more soluble than plutonium, especially in seeds, with approximately 50% of the soluble Np in roots and leaves associated with plant ligands of less than 5000 molecular weight.

5106 Regulations

Refer also to citation(s) 37227

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

Refer also to citation(s) 35873, 35916

37234 (EC/NHR/S–88016) **NOGAP C-11A. Sediment regime of lakes in the Mackenzie Delta.** Marsh, P.; Ferguson, M. Environment Canada, Saskatoon, SK (Canada). National Hydrology Research Inst. 1988. 71p. (MICROLOG–88-06252). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

During the summer of 1987, detailed hydrologic and sedimentation measurements were made on three lakes in the Mackenzie Delta near Inuvik. Due to the importance of sediments in carrying adsorbed hydrocarbon contaminants, this work on the spatial and temporal patterns of sediment deposition under different flow conditions improves the ability to predict and evaluate environmental impacts of hydrocarbon development in the Mackenzie Basin. This work illustrates the large variations in regimes found in typical lakes. Sedimentation decreases with increasing lake sill elevation and distance from the main channels. For example, the mean sedimentation rates ranged from 1.3 mm for the lowest sill elevation lake to only .02 mm for the highest lake. Large spatial and temporal variations in this sediment input were found. At one lake, 67% of all sediment was input during the brief spring flood period, and 53% of all sediment was deposited in only 6% of the lake area. Using these sedimentation data and published values of hydrocarbons adsorbed onto the suspended sediments in East Channel at Inuvik, the input of hydrocarbons into NRC, Skidoo, and South Lakes was estimated as 2,363, and 620 g or 25,961, and 996 $\mu g/m^2$, respectively, during 1987. General remarks can be made concerning the input of hydrocarbon contaminants due to accidental spills. With a knowledge of the water level during a spill, the total number and area of lakes affected could be estimated and using the data on spatial variation of sedimentation, so can the lake areas most affected. This type of information has important implications for predicting the effect of hydrocarbon development on the lakes in the Mackenzie Delta. 34 refs., 25 figs., 3 tabs.

37235 (MNR/FB–88-04) **Summary of phytoplankton data for the Nelson River and Rat-Burntwood lakes, 1987.** Livingston, L. Manitoba Dept. of Natural Resources, Winnipeg, MB (Canada). Fisheries Branch. 1988. 170p. (MICROLOG–89-00714). Available from Manitoba. Manitoba Natural Resources, Public Information Services, 1495 St. James St., PO Box 22, Winnipeg, MB, Canada R3H 0W9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This study was initiated to provide background data for assessing the impact of the Churchill River (Manitoba) hydrolelectric project diversion on the first ecology of northern Manitoba lakes. During the 1987 field season, phytoplankton samples were collected from Cross, Rat, Sipiwesk, Split, Stephens and Threepoint lakes. The phytoplankton were identified to species and biomass was calculated. In this report the emphasis was placed on identifications to genera and the occurrence of the major algal species. In the 1987 samples, with exception of Cross Lake, the dominant taxomomic order was Diatomeae. The secondary order was Cyanophyceae or Cryptophyceae. For Cross Lake, the dominant taxonomic order was Diatomeae. The secondary order was Cyanophyceae or Cryptophyceae. For Cross Lake, Cyanophyceae was the dominant order, while Diatomeae and Chlorophyceae were the secondary orders. The dominant genera for the lakes were one or a combination of Melosira, Anabaena, Pediastrum, or Rhodomonas. Compared to the 1986 phytoplantkton data, there was an increase in diversity of genera for each order. 1 ref., 7 figs., 6 tabs.

37236 (NEI-NO–82, pp. 57-68) **Hydrologic system characterisation for biogeochemical process research in forest ecosystems.** Bouten, W. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Hydrologic system characterisation is of utmost importance in biogeochemical process research. This is amplified in the first part of this paper. Within the framework of the Dutch Priority Program on Acidification, a hydrologic study supports microbiological, soil chemical and plant physiological research. This paper describes how a calibrated hydrologic numerical simulation model is used to perform sensitivity analysis with respect to water fluxes and moisture conditions within a forested catchment. First of all, the effect of errors in the determination of soil physical properties, secondly the effect of the vertical root distribution and thirdly the effects of rainfall by the canopy and the forest floor are investigated. Conclusions are drawn on the necessity of model extension and adjustment of the field monitoring programs. 2 figures, 1 table, 25 references.

37237 (NEI-NO–82, pp. 117-126) **Oxygen isotopic composition of sulphates in the uplandforest of the plastic lake watershed.** Stempvoort, D.R. van; Fritz, P.; Drimmie, R.J.; Wills, J.J. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

The upland soil water sulphate in the watershed has a distinct oxygen isotopic composition (avg. $\delta^{18}O$=5.67 0/00) relative to local precipitation sulphate (avg. $\delta^{18}O$=11.65 0/00). This is explained by chemical/bioloical reactions in the soil and/or overlying forest canopy. Throughfall and stemflow samples indicate that, at most, a very small shift (avg. 0 to 2 0/00 $\delta^{18}O$) takes place in the aboveground vegetation. SO-2 absorption to the soil, snow, or vegetation may be an important process, but preliminary data indicate no significant associated isotopic shift. Sulphate adsorption by Fe and Al oxyhydroxides in the B horizon also has a minor effect on soil water sulphate oxygen composition. Microbial mineralization of organic sulphur produces secondary sulphate and this soil process is probably the major cause of the observed isotope shift. 2 figures, 1 table, 28 references.

37238 (NEI-NO–82, pp. 127-137) **Quality of surface water evolution during snowmelt. International symposium on acidification and water pathways.** Gabriela, B.; Dusan, B. Norsk Hydrologisk Komite, Oslo (Norway). 1987. In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

The paper deals with the quality of surface water evolution during snowmelt. The results were achieved in study of snowpack and streamwater chemistry in mountainous drainage basin Bystrianka (Low Tatra mountains) in Czechoslovakia. Used data are obtained from regular measurements in the winter seasons 1984/85, 1985/86. Accumulation and evolution of sulphate levels in the both snow and

stream are evaluated during the snow accumulation and melting. The results of our observations according to the successive washout of mentioned solutes during snowmelt indicate remarcable impact on the ecosystem from acid precipitation, witch is similar to observations in northern countries. 2 figures, 3 tables, 12 references.

37239 (NEI-NO–82, pp. 185-194) **Conceptual model for analysing soil and groundwater acidification on regional scale. International symposium on acidification and water pathways.** Vries, W. de. Norsk Hydrologisk Komite, Oslo (Norway). 1987. In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

This paper presents the interim status of a simulation model for analysing long-term responses of soil and groundwater quality to acid deposition. It will be linked as a submodel in an overall framework predicting environmental impacts from energy emissions. The acidification process is conceptualized as a disturbance in (forest) element cycling. Consequently, the model utilizes (relatively simple) mechanistic descriptons of all relevant bio- and geochemical processes affecting the nutrient cycles, such as fliar uptake, foliar exudation, litterfall, root turnover, (net) mineralization, weathering, and root uptake. The model is meant to predict yearly averaged fluxes and concentrations of major ions (H, Al, Ca, Mg, NH-4, NO-3, SO-4, Cl, RCOO) in characteristic forest-soil ecosystems in the Netherlands. Preliminary show reasonable agreement with data on ion concentration near the phreatic surface. 1 figure, 2 tables.

37240 (NEI-NO–82, pp. 101-105) **Processes affectin the chemistry of waters passing through a high elevator Sierra Nevada watershed.** Nodvin, S.C. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

The Eastern Brook Lakes watershed is located in the Sierra Nevada Mountains of California and spans and elevational range from 3060 to 3780 m. Changes in stream and lake chemistries along spatial and temporal flowpaths demonstrate that both terrestrial and aquatic processes were important in regulating surface water chemistries within the 250 ha watershed. Streams generally showed increasing pH, alkalinity, and conductance values with decreasing elevation. Large changes in stream chemistries occurred over short distances at locations such as alpine meadows. During the spring, stream alkalinities and conductance values decreased while stream pH values increased with time. pH values reached their maximim in June when alkalinity and conductance values were at their minimum values. Internal lake processes strongly influenced the chemistry of Upper Eastern Brook Lake. During spring and summer, lake waters exhibited near-neutral pH, low conductance (10-12 μS/cm), low alkalinity (100-120 μEq/L), and undetectable ammonium. Under the ice, major changes in lake chemistry occurred associated with oxygen depletion in the hypolimnion. pH values decreased with time towards a minimum of 6.3 at 6 m depth. Other parameters increased w time and depth under the ice, reaching maximum values as follows: conductance > 80 $\mu S/cm^{-1}$ Gran's alkalinity > 370 $\mu Eq/L^{-1}$, and ammonium > 50 $^{m}u^{E}q/L^{-1}$. 5 figures, 10 references.

37241 (NEI-NO–82, pp. 195-205) **Effects of air pollutants on groundwater quality in the Federal Republic of Germany.** Wieting, J. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

The deposition of acid-forming air pollutants has resulted in qualitative and quantitative changes in the exchange of organic and inorganic substances between water and the surrounding media, and has led to substantial damage to biological systems. The capacity of the soil to function as a sink for pollutants is already exhausted in certain areas, and acid is being released suddenly from the soil. Groundwater and surface waters are in turn being biologically and chemically affected by this release of acid (free ion passage). With the continued acidifi- cation of soils and the transport of acid the soil profile, the endangerment of groundwater and surface waters in most areas is now a question of B'whenBB and not BBifB' . In light or this question, the first estimates for the amount of acid deposition, the buffering capacity of soils, the mobilization of heavy metals, and the degree and extent of groundwater acidification with regard to drinking water supplies have been made for the Federal Republic of Germany (FGR). 3 figures, 2 tables, 10 references.

37242 (NEI-NO–82, pp. 223-235) **Acidity of surface water in Norway.** Rosenqvist, J.T. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

The paper deals with acidity of surface water together with the ecological impact of acid precipitation in Norway. 5 figures, 18 references.

37243 (NEI-NO–82, pp. 259-268) **Increased acidity and aluminium concentration in streams following afforestation: Causative mechanisms and processes.** Hornung, M.; Reynolds, B.; Stevens, P.A.; Neal, C. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

On certain site types in the UK uplands, streams draining for coniferous plantations are more acid and contain higher concentraions of aluminium than moorland streams. The characteristics of the affected site types are outlined. The changes in processes resulting from afforestation, and which wolud produce the detected differences in streamwater chemistry are discussed using examples from 3 catchment studies in Wales. Changes in site hydrology alone are unlikely to explain the differences in streamwater chemistry, changes in the chemistry of th inputs to the streams are also required. Increased capture, and concentration, of atmospherically derived ions, particulary mobile strong-acid anions, on the forest canopy provides the main driving mechanism changing the chemistry of inputs to the stream. 5 tables, 22 references.

37244 (NEI-NO–82, pp. 249-363) **Loch Fleet Project.** Brown, D.J.A.; Howells, G.D.; Paterson, K. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

The background to the Loch Fleet Project, an acid-lake restoration research project, is described together with the initial chemical changes which resulted from the first set of lime application to the catchment in the spring of 1986. These changes are encouraging with increases in pH and calcium concentration and decreases in toxic aluminium cocentration having been observed in the surface waters draining treated subcatchments and in loch outlet. Also, the normal tendency for pH and calcium concentration to fall during times of increased flow has been reversed. 9 figures, 2 references.

37245 (NEI-NO–82, pp. 237-248) **Event studies and the interpretation of water quality in forested basin.** Keller, H.M.; Kloeti, P.; Froster, F. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

A longterm monitoring project, to observe streamflow and its quality in small forested basin in Switzerland was started in 1967. The

basins were monitored continuously for streamflow, and dissolevd nutrients were analysed in regularly taken grabsamples. More recently also precipitation chemistry (rain and snow) has been monitored to estimate dissolved soils input from the atmosphere and 3 basins been equiped with continuous flow proportional samplers This study shows the changes of concentration and loadings of nutrients in precipitation, throughfall, soil water and streamflo of 3 small catchments. Special emphasis is put on the results obtained in study on the effect of the forest canopy on precipitation chemistry. 6 figures, 2 tables, 10 references.

37246 (NEI-NO–82, pp. 325-348) **Mitigation studies.** Johannessen, M.; Hindar, A. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Mitigation research aims at obtaining information on: Advantages and limitaions of various neutralizing agents; treatment technics for lakes, river, and brooks; dose-response relationships and models; realistic goals and strategies for each project; pratical and economic realistic strategies;ecological effects of treatments on ecosystems. In addition the research programmes have given information of how ecosystems respond to stress factors such as pollutants, how different species might dominate the acidified system, and how and to what extent recolonization occurs after treatment. The research is also closely linked to acidification research as the reacidification process has been studied closely. There is a need for longterm studies connected to the ongoing liming programmens. The biologic responses on over the long term and after repeated liming treatment are still not known. Even though deleterious effects have not been observed over the short term, a question mark is put on long-term effects. The paper focuses on results from liming activities in Norway with emphasis on liming strategies and dose-response nelationships. 16 figures, 14 references.

37247 (NEI-NO–82, pp. 365-374) **Liming as a method to neutralize highly acidic drainage waters from sulphate basins in western Finland.** Bjoerkqvist, D.; Weppling. K. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Land upheaval in combination with drainage projects and flood control works cause serious acidity problems in many rivers and estuaries along the Ostrobothnian coast. Sulphide-rich sediments from the former Litorina Sea are oxidized, with a subsequent leaching of sulphates and potentially toxic soil metals into the watercourses. Extremely low pH-values (3-4) and high metal con- centrations (e.g. a total Al maximum of 80 mg/1) have been measured, leading to occasional fish deaths and severe distrubance in fish reproduction. Liming as a countermeasure was studied experimentally in 1985. Very high doses of $CaCO_3$ (200-1000 g/m3) were needed to raise the pH-value to acceptable levels, compared to the amounts needed for neutralizing waters affected by acid deposition. The elevated pH level (pH 6-7) led to a rapid precipition of Al and Fe from the water. A significantly improved survival rate was recorded for the test organisms used (roach, Rutilus and perch, Perca fluviatilis) immediately after liming, stressing the importance of high Ca-concentrations in reducing the detrimental effects of toxic metals. 5 figures, 1 table, 13 references.

37248 (SKI–86035) **Influence of spatial discretization in 3D groundwater flow calculations using the finite-element method.** Nedbal, T. Swedish Nuclear Power Inspectorate, Stockholm (Sweden). 24 Feb 1988. 14p. (KEMAKTA-AR–88-07). Order Number DE89618368/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The SKI has from the Atomic Energy Research Establishment (AERE) at Harwell, U.K., acquired the computer model NAMMU for groundwater hydrology calculations. This code was first implemented on an AMDAHL 470, an IBM compatible computer, and then modified to get integrated with HYPAC which is a program package for pre- and postprocessing finite element data, development by KEMAKTA Consultants Co. The NAMMU code was then transferred to a CYBER 205 by Control Data AB. This report describes the implementation of HYPAC on CYBER 205, enhancement of NAMMU performance on CYBER 205 and a study of the influence of spatial discretization on groundwater flow calculations.

37249 (TR-EL–82-4/82(11.100)) **Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic): Blue crab.** Hill, J.; Fowler, D.L.; Van Den Avyle, M.J. Army Engineer Waterways Experiment Station, Vicksburg, MS (USA); Fish and Wildlife Service, Washington, DC (USA); Georgia Univ., Athens, GA (USA). Georgia Cooperative Fish and Wildlife Research Unit. Mar 1989. 20p. (BR–82(11.100)). Available from OSTI - U.S. Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gause Boulevard, Slidell, LA 70458.

Species profiles are summaries of the literature on taxonomy, life history, and environmental requirements of coastal fishes and aquatic invertebrates. They are prepared to assist with impact assessment. The blue crab, Callinectes sapidus, occurs in lower reaches of freshwater rivers, estuaries, and coastal waters along the Atlantic seaboard and Gulf of Mexico, and the species supports the largest crab fishery in the United States. Chesapeake Bay provides the greatest production of blue crabs on the east coast. The blue crab's high abundance in estuaries, diverse feeding habits, and importance as prey for other marine animals indicate its important role in the structure and function of estuarine communities. Female blue crabs spawn in high-salinity lower estuaries of coastal areas; the resulting larvae are planktonic and develop into juveniles at 5 to 10 weeks of age. Juveniles gradually migrate into shallower, less-saline upper estuaries and rivers where they grow and mature at 1-2 yr of age. Mating occurs in the upper estuaries after which females migrate to areas having higher salinities. Growth and survival of blue crabs are strongly affected by water temperature and salinity, but tolerances vary with life stage. Larvae require temperatures of 20-30°C and salinities of 10-30 ppt for proper development, but salinity and temperature tolerances are broad for advanced juveniles and adults. Blue crabs use nearly all areas within estuaries as nursery habitat, and crab populations are sensitive to changes in physical features of contamination of these areas. 94 refs., 4 figs., 2 tabs.

37250 Effects of structure on scattering from marine organisms. Quinby-Hunt, M.S. (Marine Sciences Group, and Applied Science Div., Lawrence Berkeley Univ. of California, Berkeley (US)); Hunt, A.J. v.v of Ocean optics IX. Blizard, M.A. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-880410–: Ocean optics 9, Orlando, FL, USA, 4-6 Apr 1988).

Microscopic particulates (organisms and non-living components) in the ocean are responsible for the largest and most variable component of oceanic scattering. Marine scattering is dominated by small unicellular populations that are the most effective organisms per unit mass for scattering and absorption. Most unicellular organisms important for scattering can be identified as members of groups that are selfsimilar (that is, they have the same structure) and can be described in terms of simple geometric forms or combinations thereof. Thus the light scattering characteristics of prevalent marine populations may be predicted by applying particular scattering theories. This is a complementary approach to current methodologies for the prediction and interpretation of the radiative transport properties of the ocean. To better predict realistic scattering from marine organisms, structural models for small unicellular oceanic organisms are being implemented. For a few special geometries (spherical symmetries, infinite cylinders), rigorous calculations can be performed for unrestricted size and optical properties. Models based on the Rayleigh-Debye approximation allow many more shapes but are only valid for a restricted range of sizes and optical properties.

37251 Immobilization of unicellular marine organisms for optical characterization. Lofttus, K. (Applied Science Div., Lawrence Berkeley Lab. (US)); Hunt, A.J.; Livolant, F.; Maestre, M.F. v.v of Ocean optics IX. Blizard, M.A. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-880410–: Ocean optics 9, Orlando, FL, USA, 4-6 Apr 1988).

A new method has been developed to study the light scattering properties of single, immobilized unicellular marine organisms. Cells

of the dinoflagellate Prorocentrum micans were fixed and immobilized by mixing them into a solution that formed a transparent gel. The residual Rayleigh scattering caused by the gel was effectively eliminated by substituting a second liquid into the gel to match the index of refraction of the gel network, thereby producing a transparent support medium. Scattering measurements of the elements of the Mueller matrix were performed on a single Prorocentrum micans cell using a polarization-modulation scanning nephelometer. The angular dependence of S_{11} and normalized S_{12}, S_{22}, S_{33}, S_{34}, S_{13}, and S_{14} are presented. The structure in all elements is very rich, cell orientation dependent, and completely reproducible. The measurements also revealed significantly non-zero values for all 16 elements of the scattering matrix and the non-equivalence of cross-diagonal elements. A striking feature of the measurements is the large peak values of S_{14} for a single immobilized cell. In recent years S_{14} has generally been reported to be zero for sea water and very small for laboratory systems.

37252 **Microbial colonization on natural and artificial macrophytes in a phosphorus-limited, hardwater lake.** Burkholder, J.M. (Michigan State Univ., Hickory Corners (USA)); Wetzel, R.G. *Journal of Phycology (USA),* 25(1): 55-65 (Mar 1989).

Epiphyte communities in a phosphorus-limited hardwater lake were compared over a 14-week period from Potamogeton illinoensis and structurally similar artificial plants of different leaf ages. Artificial plants were serially incubated in the lake to simulate the age of natural leaves. The physiognomy of loosely attached epiphytes appeared similar on the two substrata. Algal cell number and biovolume were 15-fold and 17-fold higher, respectively, on artificial leaves early in the growing season, but total algal density gradually became similar on natural and artificial plants. In contrast, the taxonomic composition of loosely attached algae became increasingly distinct, and mean cell biovolume on natural leaves was twice that on artificial leaves. Adnate epiphytes on both substrata developed from sparse populations of bacteria on new leaves to a community of diatoms, blue-green algae and numerous bacteria on mature and senescent leaves. Adnate community succession on natural leaves in late senescence/death differed from that on artificial leaves colonized for comparable periods in having (1) a marked increase in filamentous blue-green algae, (2) a subsequent decrease in all algae, and (3) a final fungi-dominated stage. The trends in colonization indicate that macrophytes in this oligotrophic lake provided a distinct habitat from that of artificial substrate for epiphytes throughout the growing season.

37253 **Photoadaptation and the package effect in Dunaliella tertiolecta (Chlorophyceae).** Berner, T. (Bar Ilan Univ., Ramat Gan (Israel)); Dubinsky, Z.; Wyman, K.; Falkowski, P.G. *Journal of Phycology (USA),* 25(1): 70-78 (Mar 1989).

In the marine unicellular chlorophyte, Dunaliella tertiolecta Butcher, the spectrally averaged in vivo absorption cross section, normalized to chlorophyll a (so-called a* values), vary two-fold in response to changes in growth irradiance. The authors used a kinetic approach to examine the specific factors which account for these changes in optical properties as cells photoadapt. Using Triton X-100 to solubilize membranes, they were able to differentiate between package effects and pigmentation effects. Their analyses suggest that 43-49% of the variability in a* is due to changes in pigmentation, whereas 51-57% is due to the package effect. Further analyses revealed that changes in cell size did not significantly affect packaging, while thylakoid stacking and the transparency of thylakoid membranes were important factors. Their results suggest that thylakoid membrane protein/lipid ratios change during photoadaptation, and these changes influence the effective rate of light harvesting per unit chlorophyll a.

37254 **Distribution, abundance, and transport of larval sciaenids collected during winter and early spring from the continental shelf waters off west Louisiana.** Cowan, J.H. Jr. (Louisiana State Univ., Baton Rouge (USA)); Shaw, R.F. *Fishery Bulletin (USA),* 86(1): 129-142 (Jan 1988).

The larvae of six species of Sciaenidae were collected in continental shelf waters off west Louisiana on five midmonthly ichthyoplankton cruises from December 1981 to April 1982. Ranked in order of abundance these species were sand sea trout, Cynoscion arenarius; Atlantic croacker, Micropogonias undulatus; spot, Leiostomus xanthurus; black drum, Pogonias cromis; southern kingfish, Menticirrhus americanus; and banded drum, Larimus fasciatus. Total larva density was highest in April, and the high densities were associated with the coastal boundary layer, a horizontal density front caused by an intrusion of fresher water onto the inner shelf that probably issued from the Atchafalaya River east of the study area. Spawning by sand sea trout began in January, two months earlier than previously reported, and first occurred offshore of midshelf but moved shoreward as the season progressed. Analysis of length-frequency data suggest that spot probably began to spawn in November, one month earlier than once thought. Both sand sea trout and Atlantic croaker larvae were captured at higher rates at night than during the daytime. Sand sea trout larvae appear to be somewhat surface oriented while spot may undergo vertical migration. Interpretation of the sciaenid data support a previously developed transport hypothesis involving gulf menhaden larvae and west-northwest alongshore advection within and just outside of a horizontally stratified coastal boundary layer.

5202 Chemicals Monitoring and Transport

Refer also to citation(s) 35566, 35898, 35899, 35960, 35964, 35965, 35966, 35967, 36434, 36439, 36440, 36441, 37204, 37215, 37216, 37221, 37222, 37223, 37390, 37391, 37392, 37395

37255 (DP-MS–88-185) **Managing data from a large-scale groundwater monitoring program.** Lorenz, R.; Fay, W.; Killeen, T.; Sims, W.R. Westinghouse Savannah River Co., Aiken, SC (USA). 1989. 14p. Sponsored by DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-8906138–1: International symposium on the design of water quality information systems, Fort Collins, Colorado, USA, 7-9 Jun 1989). Order Number DE89013710/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of the paper is to describe how the SRS groundwater data management system is used to verify, manipulate, and store groundwater data and how it is used to fulfill regulatory requirements. This paper will describe the development of the M-Area groundwater data management program and will focus on how well, field and analytical data from this program are managed. 7 figs.

37256 (EC/IWD–7) **Proceedings of the technology transfer workshop [for] northern water quality monitoring.** Environment Canada, Ottawa, ON (Canada). Inland Waters Directorate. 1988. 161p. (CONF-8705380–: Technology transfer workshop [for] northern water quality monitoring, Yellowknife, Canada, 4-7 May 1987;MICROLOG–88-06242). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A workshop was held for leading experts in northern aquatic ecology to present research results on techniques of water quality monitoring and their application in the Yukon and the Northwest Territories. Presentations and discussions were made in the areas of water quality information needs, monitoring activities in the North being conducted by various agencies, water quality research projects in specific geographical areas, and water quality impacts from mining and from hydrocarbon-related activites. This report includes summaries of research and transcripts of the discussions. 2 refs., 21 figs., 2 tabs.

37257 (EC/IWD–157) **A large-sample extractor for determining organic contaminants in the Great Lakes.** Neilson, M.A.; Stevens, R.J.J.; Biberhofer, J.; Goulden, P.D.; Anthony, D.H.J. Environment Canada, Ottawa, ON (Canada). Inland Waters Directorate. 1988. 30p. (MICROLOG–88-06238). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The construction and operation of two large-sample extractors are described. They can extract water at up to 1 l/min and were used to extract water samples of approximately 50 l volume with dichloromethane during the monitoring cruises on lakes Erie, Huron, Ontario, and Superior in early 1986. Both whole water and clarified

water were extracted. The dichloromethane extracts were later analyzed for organochlorines, chlorobenzenes, polychlorinated biphenyls, and polynuclear aromatics by the National Water Quality Laboratory in Burlington, Ontario. A solution containing surrogate standards was continuously added at a fixed rate to the water being extracted. The recoveries of these surrogates provide a continuous measure of the extraction efficiency and reproducibility of the analytical process, and confirm that the processes used are valid. 5 refs., 13 figs., 5 tabs.

37258 (NEI-NO–82 vp.) **Is the deposition of anthropogenic sulphate onto Scandinavia mature for a harrowing reconsideration ?.** Sorensen, N.A. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

The paper deals with the deposition of antheropogenic sulphate onto Scandinavia. Two connections are studied. The first one concerns the concentration of the major ions in seven large Swedish rivers covering the range 60-65 NL during the period 1965 -1981. The second one concerns the investigation of the sulphate concentration in Norwegian lakes lying in a Huvial basin giving minimal weathering. Mineral weathering renders calcium in the largest amounts, 8 figures, 2 tables, 19 references.

37259 (NEI-NO–82, pp. 29-35) **Alkalinity production in soil and rock: A useful concept for understanding acidification of soil and freshwater.** Eriksson, E. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Weathering in hard rocks except limestones is, fundamentally a process of hydrolysis of primary minerals. It seems to be relativly independent of pH in fairly wide range, at least for feldspar minerals. This implies a more or less constant rate of alkalinity increase (or acidity decrease) along flow paths of underground waters. Considering the general flow patterns underground one will obtain a general stratification of acidity/alkalinity in the water all according to the age distribution. This means usually an increase in alkalinity (or decrease in acidity) with depth. However, in lakes and streams the resulting acidity/alkalinity is only dependent on the surface area of primary minerals in contact with water, not on the flow patterns, down to depths where calcite formation consumes the alkaliced alkalinity produced or mineral transformations occur that preserve the potential alkalinity of the minerals. Flow path patterns are, however, important for the specific seasonal variation in the alkalinity/acidity of run-off that takes place. Considering acid deposition the root zone will carry the heaviest part of the load followed by shallow groundwater while the deep groundwater will usually escape the acid deposition effect. Surface waters, being at the end of the water circulation path, shows the capacity of the basin to resist acidity. Estimates of alkalinity production rates can be made from knowlegde of the specific discharge and the chemistry of surface waters. 3 figures, 1 table, 13 references.

37260 (NEI-NO–82, pp. 15-28) **Attenution of acidity in groundwater flow systems.** Edmunds, W.A. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Acid groundwaters with alkalinities of 50 mg HCO-3/l or less are found in a variety of hard rock terrains and also in some sedimentary rocks such as sands, sandstones and grits. The extent to wich the rainwater acidity (H^+) is attenuated in the bedrock is primarily dependent upon the mineralogy, the degree of water-rock contact and hydrological pathway. It is suggested that the calcite saturation index (SI-c) of streams and groundwater can provide a good estimate of the bedrock sensitity and examples of its use in studies in Scotland and northwest England are given. Deeper groundwaters in the Permo-Triassic sandstones of estern England contain a record of atmopheric inputs over 1000 years and demonstrate the extent of industrial contamination of groundwater. Unsaturated zone profiles may also a way of establishing short term (10-100 y) records of acid inputs and attenuation of acidity. 7 figures, 10 references.

37261 (NEI-NO–82, pp. 37-55) **Use of representative field plots for the determination of hydrological flow-paths and associated hydrochemistry in studies of surface water acidification.** Langan, S.J.; Wheater, H.S.; Miller, J.D.; Ferrier, R.C. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Experimental plots have been establihed, as part of the SWAP (surface water acidification project) research programme, on representative soil series of tow experimental areas in Scotland. The plots are hillslope segments, draining to cut soil faces with throughflow trays at the base of the major soil horizons. Baseline monitoring of accumulated precipitation, stemflow, throughfall and throughflow is carried out at fortnightly intervals. A number of plots have been augmented to include continuous recording of precipitation and throughflow, evnt sampling of precipitation and throughflow chemistry and continuous monitoring of soil moisture dynamics using a distributed tensiometer network. The utility of these experiments in defining hydrological flow paths and associated hydrochemistry are discussed with reference to selected results from the 1986 field season. 7 figures, 5 tables, 21 references.

37262 (NEI-NO–82, pp. 91-100) **Precipitaton, surface and subsurface water chemistry in a tolerant hardwood forest basin.** Nicolson, J.A.; Craig, D.; Foster, N.W. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Water quality in the terrestrial portion of the Wishart Lake basin in the Turkey Lakes watershed, Ontario, was characterized in 1983, Ion concentrations in precipitation, soil water, groundwater at depths up to 7 m, and streamwater at two locations were examined. Mean annual H^+ concentrations decreased while alkalinity and Ca^{2+} increased with depth below the soil surface and with the length of the groundwater flow path. Solutions were dominated by Ca^{2+} and SO_4^{2-} in the unsaturated and shallow groundwater zones and in streams, and by Ca^{2+} and alkalinity in deeper groundwater. Lower alkalinity and Ca^{2+} concentrations in one streams suggested that it received a greater proportion of water from shallow groundwater and hence was more sensitive to acid inputs. With respect to watershed acidification. SO_4^{2-} from atmospheric acid deposition was supplemented by SO_4^{2-} released from the soil zone. Geochemical weathering of carbonates in the till was the major reaction controlling groundwater alkalinity, and through groundwater discharge, streamwater alkalinity. Biotic and abiotic reactions in the basin seem to be regulating drainage water chemistry more than the chemistry of precipitation. 3 figures, 2 tables, 9 references.

37263 (NEI-NO–82, pp. 107-116) **Size distribution patterns for trace elements in waters draining a small catchment, S.E. Norway.** Lydersen, E.; Salbu, B.; Bjoernstad, H.E.; Englund, J.O.; Hovind, H.; Rambaek, J.P. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Trace elements in natural fresh waters may be present in different physico-chemical forms varying f.inst. in size. Other components

(e.g. humicsubstances clay minerals) present in the waters will influence the distribution patterns of trace elements as transformation processes (e.g.sorption, complexation, aggregation, dispersion) occur. The presence of different species varying in size, charge and density will, affect the transport, the mobility and the bioavailability of an element of interest. Size fractionation techniques are appropriate for distinguishing between categories of species (e.g.low molecular weight species, colloids, particles) In the present work in situultrafiltration using hollow fibres has been utilized for studying changes in groundwaters being exposed to surface surrounding. Sampling has taken place in the catchment, at a groundwater spring and 3 sampling sites downstream. The total concentrations and the size distribution patterns for most trace elements investigated changes rapidly due to the surface expos and are to a large extent influenced by the contribution of organic substances downstreams. 4 figures, 1 table, 7 references.

37264 (NEI-NO–82, pp. 163-172) **Experience from integated simulations of runoff, water quality and residence time. International symposium on acidification and water pathways.** Bergstroem, S.; Lindstroem, G. Norsk Hydrologisk Komite, Oslo (Norway). 1987. In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Simulation of short term natural variations of pH and alkalinity in natural rivers can be accomplished by a conceptual water balance model with a rather simplistic hydrochemical substructure. This is supported by experience from applications of the PULSE-model in several Swedish basins. Detailed hydrochemical models require more physically based hydrological models with a realistic description of the residence-time of water. Such a model structure is lined out, and its verification with data on rainfall, runoff and the stable isotope oxygen-18 is shown. The transit time distribution of the model is further tested by a tracer experiment with tritium injected in a shallow till aquifer. 9 figures, 7 references.

37265 (NEI-NO–82, pp. 173-184) **Relation between water flow paths in the soil and runoff chemistry at Risdalsheia, a small headwater catchment in southern Norway.** Hauhs, M. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Runoff at the EGIL-catchment (hatched areas represent bare rock) is acidified and stems from a thin, patchy, and poorly developed soil. The fact that the whole catchment is covered by a roof that extends 2-3 meters beyond its boundaries provides an outstading possibility to control catchment hydrology. The patterns of soil water movement during storm runoff were identified by automatically recording tensiometers. Even under flow conditions equivalent to 50 (mm/day) no signs of surface flow or components bypassing the soil were found. Flow occurred near the soil surface and was mixed with resident soil water. The role of these pathways for the interaction between solution and rundoff chemistry was investigated by a tracer experiment with LiBr as the tracer solute. The tracer episode was conducted under hydrologic steady-state conditions. During the episode soil solution throughout the catchment was monitored by 16 lysimeters. Chemical changes due to soil/soil-solution interaction occurred mainly during unsaturated, vertical infiltration. Saturated, lateral flow caused high porewater velocities (> 10 m/hr) and only SO-4, NO-3, and H were changed along the horizontal flow path. Sulfate in runoff after the dry period that preceeded the tracer episode partly came from oxidation of reduced S in stangnat pockets of soil. The key processes that explain the behavior of stormflow chemistry at the EGIL-catchment are: subsurface, translatory flow and equilibrium reactions along vertical transport across the vadose zone. These results correspond to observations from other headwater catchments that are much larger in size. 5 figures, 3 tables, 16 references.

37266 (NEI-NO–82, pp. 249-258) **Aluminium dynamics in response to experimental additions of acid to a small Norwegian stream.** Norton, S.A.; Henriksen, A.; Wathne, B.M.; Veidal, A. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

The paper deals with aluminium dynamics in response of acid to experimental additions of acid to a small Norwegian stream which was experimentally acidified four times to a pH near 4 with H_2SO_4. Each experiment lasted approximately 24 hours. Over 50 percent of th acid was neutralized in 135 m of stream bed by the release of Ca. Mg, and Al from the streams bed as well as protonation of HCO_3. Ca release declined in a few hours and was only slightly regenerated after 48 hours of normal flow and chemistry. Neutralization of H+ by Al dissolution was initially dominated by the release of aluminum from a rapidly dissolevd but small pool which was not regenerated after two days and subsequently by a large reservoir of slightly less soluble Al. Al concentration approached values in equilibrium with the stream pH within 80 m. This indicates that episodes of depressed pH and elevated Al streams are probably initially largely controlled by the release of Ca from the stream bed. This process is dominated by moss in Bonnabekken. 2 figures, 3 tables, 8 references.

37267 (NEI-NO–82, pp. 281-290) **Hydrologic and chemical characteristics of darkwater, clearwater and acidic lakes in the United States.** Brakke, D.F.; Eilers, J.M.; Landers, D.H. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Major differences were found in the distribution of lake types between areas. Drainage lakes were most common in the Northeast and West. Seepage lakes were common in some areas of the Upper Midwest (59% of the lakes in Northcentral Wisconsin) and Florida (66%). Seepage lakes represented 18% of the lakes in the West. Seepage lakes in Northeast had ANC values similar to drainage lakes whereas seepage in the Upper Midwest and Florida had lower ANC compared to drainage lakes. Reservoirs in all regions had the highest median ANC Ca^{2+}. Hydrologic residence times were two to three times shorter in the Northeast than in the Upper Midwest, but DOC was inversely related to residence time in both areas. . Clearwater lakes suggesting the acidic lakes were derived from low DOC, clearwater lakes. 4 figures, 3 tabels, 14 references.

37268 (NEI-NO–82, pp. 377-391) **Effect of acidification on structures in soil and water.** Kucera, V. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Increased corrosion due acidification of water and soil may arise in susceptible areas as one of the long-range transport of air pollutants. Corrosion in soil is a complicated process and dose reponse relations between the corrosion rate and acidification parameters are lacking. Distribution mains, galvanized foundations of power line towers and lead sheathed cabels belong to potentially susceptible structures. Falling alkalinity and pH increase the corrosion rate of steel, copper, zinc and lead in water. Increased internal corrosion of water pipes is considered a great technical problem and elevated lead contents in tap water create also a potential health hazard. 7 figures, 43 references.

37269 (NEI-NO–82, pp. 393-402) **Corrosion aggressiveness og groundwaters on the underground route in Warsaw.** Pich, J.; Rebas, E. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577-–: International symposium on acidification and water

pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Hydrochemical research has proved that ground waters in quaternary formations through which the Warsaw underground passes are very strongly polluted. The chemism of these waters considerably varies from the natural hydrochemical background. This is result of prolonged urbanization of the area and communal and industrial waters are the source of contamination. Over the decades, as the anthropogenic influence has became more intensive, degradation of the quality of groundwaters will increase. It is a widely acknowledged phenomenon that polluted groundwaters are much more aggresive towards iron concrete. This fact forces us to use proper anticorrosive materials and technologies at all Warsaw underground building sites and raises the overall costs of this construction. 4 firgures, 2 tables, 2 references.

37270 (NEI-NO–82, pp. 405-416) **Prediction models for acidification.** Kaemaeri, J. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Only in recent years with the fast development of modern computers has analysis of ecological systems become a practical possibillty. Systems analysis implies a description of the system and its processes, i.e. a development of model representing real system, the behavior of which closely resembles that of the real system. Two broad categories of models can be distinguished capable of predicting acidification: Research models and Management models. In acidification research, models of the first type have proved useful in their hypothesis-generating role as well as in improwing our understanding of the important mechanisms of acidification. Management models, in turn, can significantly assist in the evaluation of emission control strategies. There are two basic ways of using a prediction model in a decision- marking context: scenario analysis and optimization analysis. The different ways to use prediction models are discussed. 3 figures, 1 tables, 23 references.

37271 (NEI-NO–82, pp. 417-434) **Modelling long term stream acidification trends in upland Wales.** Whitehead, P.G.; Neale, R.; Paricos, P. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

Historical reconstructions and predictions of streamwater acidification are presented for mooreland and afforested catchments in the Welsh Uplands at Plynlimon and Llyn Brianne. The model MAGIC (Model of Acidification of Groundwater in Catchments) is used to illustrate that atmospheric deposition and conifer afforestation can increase stream acidity. The historical trends determined by the model illustrate that long term acidification has been present since the turn of the century and will continue unless either deposition levels are reduced significantly or liming is undertaken on a major scale. 11 figures, 5 tabels, 29 references.

37272 (NEI-NO–82, pp. 435-444) **Mathematical model for podzolic soil profiles exposed to acid deposition.** Sverdrup, H.U.; Warfvinge, P.G.; Broemsen, U. von. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

A simple model for soil acidification describes the observed pH and base saturation profiles in a Swedish podzol affected by acid deposition. The models is based on a mechanistic respresentation of ion exchange and the weathering rade and is based on a mass balance for calcium and alkalinity. 5 figures, 3 tables, 17 references.

37273 (NEI-NO–82, pp. 447-458) **Acidification and water pathways. What about the future?.** Seip, H.M. Norsk Hydrologisk Komite, Oslo (Norway). 1987. (CONF-870577–: International symposium on acidification and water pathways, Bolkesjo, Norway, 4-8 May 1987). In *Acidification and water pathways. Vol. 1. Proceedings of International symposium on acidification and water pathways, Bolkesjoe, 4-5 May 1987.* Order Number DE89766881/JAW. Available from NTIS (US Sales Only), PC A20/MF A01.

The paper gives a short review of present knowledge of acidification of soils and water and gaps in knowledge identified. on this basis research needs are pointed out. Future trends in deposition of S and N compounds and likely developments in acidification of soil and water are discussed. 3 figures, 20 references.

37274 (PB–89-169171/XAB) **Persistent Marine Debris, challenge and response: the Federal perspective.** Alaska Univ., Fairbanks, AK (USA). Sea Grant Program. 1988. 50p. Available from NTIS, PC A03.

See also PB–89-109938. Color illustrations reproduced in black and white.

Information in the publication is drawn from the 1988 Report of the Interagency Task Force on persistent Marine Debris. The subject areas included in the report are: scope of the problem; sources of marine debris; effects on wildlife and humans and what measures are being done to prevent the problem.

37275 (PB–89-170344/XAB) **AQUIRE: Aquatic Toxicity Information Retrieval data base. Data file.** Anderson, E.; Pilli, A. Environmental Protection Agency, Duluth, MN (USA). Environmental Research Lab. 13 Mar 1989. mag ta Available from NTISCP T02.

Source tape is in the ASCII format. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. For price at 6250 bpi density, call NTIS Computer Products.

The purpose of Aquatic Toxicity Information Retrieval (AQUIRE) data base is to provide scientists and managers quick access to a comprehensive, systematic, computerized compilation of aquatic toxicity data. Scientific papers published both nationally and internationally on the toxicity of chemicals to aquatic organisms and plants are collected and reviewed for AQUIRE. Independently compiled data files that meet AQUIRE parameter and quality assurance criteria are also included. Selected toxicity-test results and related testing information for any individual chemical from laboratory and field aquatic toxicity tests are extracted and added to AQUIRE. Acute, sublethal, and bioconcentration effects are included for tests with freshwater and marine organisms. The total number of data records in AQUIRE now equals 104,500. This includes data from 6000 references, for 5200 chemicals and 2400 test species. A major data file, Acute Toxicity of Organic Chemicals (ATOC), has been incorporated into AQUIRE. The ATOC file contains laboratory acute test data on 525 organic chemicals using juvenile fathead minnows. The complete data file can be accessed by requesting review code 5 as a search parameter.

37276 (PNL–6955) **Hanford Site implementation of the National Environmental Policy Act: Activities tracking.** Killinger, M.H.; Selby, K.B. Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 33p. Sponsored by DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Order Number DE89014162/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The National Environmental Policy Act (NEPA) environmental review process is mandatory for federal agencies. This report provides the DOE Richland Operations Office (DOE-RL) and the Hanford contractors with a method for tracking, integrating, and coordinating NEPA compliance activities at the Hanford Site. The environmental review process is briefly described and illustrated in a flow chart. The report then explains a method for developing project timecharts that show when documents or decision points were completed or are projected to be completed. The tracking system has been automated and placed on the Hanford Local Area Network (HLAN). Time schedules for many Hanford projects are available for viewing. 4 refs., 6 figs.

37277 Determinants of Daphnia clonal diversity in lakes. Kolasa, J. (Univ. of Windsor, Windsor, Ontario (CA)); Mort, M. *Bulletin of the Ecological Society of America (USA),* 68(3): 343 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

Populations of Daphnia show high clonal diversity in large lakes. Hypothetically, this diversity may be maintained by either intrinsic population mechanisms such as reproductive strategies or by structuring properties of habitat such as heterogeneity and associated scale differences. To discriminate between these two classes of factors the authors have applied a predictive hierarchichal model to clone data from 9 northern German lakes (46 clones; N=1236). The model operated reliably by using ecological ranges (a course measure of heterogeneity) of taxa. Concordance of observed patterns and predictions of the model would favor the heterogeneity hypothesis, while the opposite result would suggest greater influence of population-based mechanisms in explaining clonal diversity/abundance patterns. The results of their analysis point towards habitat heterogeneity as the dominant determinant of diversity and abundance structure of Daphnia populations in lakes.

5203 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 35785, 35786, 37204, 37227, 37229, 37230, 37231, 37232

37278 (EPA–520/5-88-016) **Radiological surveys of Naval Facilities on Puget Sound.** Lloyd, V.D.; Blanchard, R.L. Environmental Protection Agency, Washington, DC (USA). Office of Radiation Programs; Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility. Mar 1989. 33p. Sponsored by Environmental Protection Agency. Available from OSTI - US Environmental Protection Agency, Office of Radiation Programs, 401 M. Street SW, Washington DC 20460.

The radiological surveys of Puget Sound Naval Shipyard, Submarine, Base, Bangor, and the proposed site for the Carrier Battle Group Homeporting Project at Everett provide the basis for the following conclusions: A trace amount of Co-60 (0.04 {+ } 0.01 pCi/g) was detected in one sediment sample at PSNS. All other radioactivity detected in the eighty sediment samples is attributed to naturally occurring radionuclides or fallout from past nuclear weapons tests and the Chernobyl reactor accident in 1986. Results of core sampling did not indicate any previous deposit of Co-60 in the sediment. Water samples contained no detectable levels of radioactivity other than those occurring naturally. Two mollusk samples collected at SUBASE Bangor contained trace amounts of Ag-110m. The presence of this radionuclide was confirmed by decay measurements. The source of Ag-110m was not determined, but is possibly due to fallout from the Chernobyl reactor accident. All other radioactivity detected in the biota samples is attributed to naturally occurring radionuclides or fallout from past nuclear weapons tests. External gamma-ray measurements did not detect any increased radiation exposure to the public above natural background levels. The preoperational survey of the proposed site at Everett confirmed the presence of only background levels of radioactivity. Based on these surveys, current practices regarding nuclear-powered warship operations have resulted in no increases in radioactivity that would result in significant population exposure or contamination of the environment. 17 refs., 4 figs., 4 tabs.

37279 (EPA–520/5-88-019) **Radiological survey of San Diego Bay.** Semler, M.O.; Blanchard, R.L. Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility. Jun 1989. 25p. Sponsored by Environmental Protection Agency. Available from OSTI - US Environmental Protection Agency, Office of Radiation Programs, 401 M Street SW, Washington, DC 20460.

A radiological survey of three sites in San Diego Bay provided the basis for the following conclusions: 1. Small quantities of Co-60 (0.02-0.05 pCi/g) are present in the bottom sediments in some areas of the harbor at the Submarine Base. Most, if not all, of the Co-60 contamination present probably originated prior to the earlier 1967 survey that reported Co-60 levels as much as 300 times larger than those observed in this study. The highest Co-60 concentration measured is now less than one percent of the normal background radioactivity in harbor sediment samples. 2. No tritium or gamma-ray emitters, other than trace amounts of those occurring naturally, were detected in surface water from the dock areas or in nearby drinking water supplies. 3. Only radionuclides of natural origin and trace amounts of Cs-137 from fallout of previous nuclear weapons tests were detected in samples of kelp, algae, and fish taken from the harbor at the Submarine Base. 4. Gamma-ray surveys of the harbors near the docking areas and along shorelines and beaches near the shipyards failed to detect any exposure rates above background. 3 refs., 4 figs., 3 tabs.

5205 Site Resource and Use Studies

Refer also to citation(s) 35876, 35877, 35878, 35879, 35880, 35881, 35882, 35883, 35884, 35885, 35886, 35887, 35888, 35889, 35890, 35891, 35892, 35893

5206 Regulations

Refer also to citation(s) 37220, 37227

37280 (PB–89-162283/XAB) **Fiscal year 1987 program report (Massachusetts Water Resources Research Center). Annual report.** Godfrey, P.J. Massachusetts Univ., Amherst, MA (USA). Water Resources Research Center. Dec 1988. 64p. Available from NTIS, PC A04/MF A01.

See also PB–88-223516.

The 1987-88 Massachusetts WRRC program (Federal FY87) focused on areas of high priority for the state and region: acid-deposition impacts, minimization of nitrate ground-water contamination, drinking water pricing, and proposed water diversion from a 'Wild and Scenic' river. The Water Resources Institute Program (WRIP) projects studied central Massachusetts cloud and fog acidity, peat use in rural sewage systems to minimize nitrate ground-water contamination, and determination of true water costs to help plan new sources or infrastructure renovation.

37281 (PB–89-175459/XAB) **Evaluation criteria guide for water-pollution prevention, control, and abatement programs. Technical manual.** Department of the Army, Washington, DC (USA). 23 Apr 1987. 152p. (DA-TM–5-814-8). Available from NTIS, PC A08/MF A01.

The manual describes principles and procedures to be followed in formulating and conducting a water-pollution prevention, control, and abatement program, and in planning facilities required for solution of water pollution problems. The manual provides guidance for selecting and applying proven technologies for waste-water treatment and for solids handling and disposal. Both capital expenditures and operating costs are outlined. While the manual is directed primarily toward handling of domestic waste-waters, system alternatives for handling special process wastes from munitions manufacture and processing, metal plating, washrack, photographic, laundry, hospital and other sources are also addressed. The manual includes technical and cost information needed for project decisions and supporting data.

53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social and Economic Studies

37282 (CRSL–ESRF087) **Planning for large-scale construction projects. A socio-economic guide for communities, industry, and government.** Storey, K.; Shrimpton, M. Community Resource Services Ltd., St. John's, NF (Canada). 1987. V (MICROLOG–89-00755). Available from Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, ON, Canada K1A 0E4; $18.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Large-scale construction projects such as power plants bring both benefits and problems for communities near the project sites. Those communities need to know about possible socio-economic effects and ways to deal with them. It is important for the community, government, and industry to know about the likely effects of construction projects. Then they can assess more accurately the costs and the benefits of the project and therefore in a better position to seek or allocate financial resources. Most importantly, they can develop planning strategies prior to the project. Advance planning helps to prevent some adverse effects, to minimize or mitigate others, and to enhance beneficial ones. This guide provides information that will help local people, government officials, and developers to develop plans for the successful management of large-scale construction projects. A traditional planning model is adopted in which impact issues are identified, strategies to deal with them are selected and implemented, outcomes are monitored, and adjustments are made as necessary. The guide is organized into four sections: the planning process; the impact assesment and screening process; possible management strategies dealing with issues such as employment, transportation, accommodation, community services, funding, and wind-down; and a list of supplementary sources of information about community planning, impact assessment, and growth management. 30 refs., 3 figs., 2 tabs.

37283 (SU/G–2-86) **A guide to socio-economic impact monitoring in the Northwest Territories.** Bone, R.M.; Stewart, D.A. Saskatchewan Univ., Saskatoon, SK (Canada). Dept. of Geography. 1987. 54p. (MICROLOG–88-06138). Available from Indian and Northern Affairs Canada, Reference Centre, Les Terrasses de la Chaudiere, Ottawa, ON, Canada K1A 0H4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A monitoring program was conducted to investigate the economic and social effects of an oilfield expansion and pipeline project on northern peoples in Canada. The goals of this report are to document the essential elements of the program and to make recommendations for future monitoring efforts in the Northwest Territories. The basic principle underlying this report is that socio-economic monitoring of large-scale industrial projects is an important government function and that monitoring, by providing socio-economic impact information, helps to formulate policy aimed at reducing regional economic and social inequalities. The purpose of monitoring is twofold: to record the economic and social characteristics of a population over time and to identify changes in that population caused by the construction of a large-scale industrial project; and to improve the management of development impacts. The first step in the monitoring program involved community surveys to gather necessary socio-economic information from households and businesses. Particular attention was paid to the impacts on native peoples. Data were gathered for three key periods: pre-construction, construction, and post-construction of the pipeline and related facilities. Responses were recorded in a form facilitating computerized data processing. The design of the monitoring program is discussed, considering the data needed, the selection of questions, questionnaire design, and data collection procedures. Field survey methods, creation and maintenance of a data base, and creation of reports are also described. Recommendations are provided for future monitoring programs.

5302 Assessment of Energy Technologies

Refer also to citation(s) 35971, 36235, 36270

55 BIOMEDICAL SCIENCES, BASIC STUDIES

37284 (PB–89-162002/XAB) **Preliminary assessment of habitat protection needs for West Indian manatees on the east coast of Florida and Georgia. Final report.** Marine Mammal Commission, Washington, DC (USA). Dec 1988. 121p. Available from NTIS, PC A06/MF A01.

The report assesses information on the status of endangered West Indian manatees (Trichechus manatus) on the east coast of Florida and Georgia in the southeastern United States and recommends actions to improve protection of the species and its habitat in that area. Manatees on the east coast of Florida and Georgia appear to constitute a discrete population numbering perhaps 700 to 900 animals. Based on carcass-salvage data, recent annual mortality rates of between 8% and 10% are indicated. Perhaps 3% to 4% of the population was killed as a result of collisions with boats during 1987, and this threat appears to be increasing. Collisions with boats and destruction of essential habitat are the principal threats to the population. Recommendations include: quadruple the size of the boat-speed regulatory system on the east coast of Florida; limit development in essential manatee habitats; acquire additional manatee habitat as additions to Federal and State refuges and preserves.

5502 Biochemistry

Refer also to citation(s) 37141, 37143, 37301, 37302, 37304, 37307, 37309, 37310, 37312, 37313, 37325, 37387

37285 (ANL/MCS-TM–132) **Generating alignments of genetic sequences.** Butler, R.; Butler, T.; Foster, I.; Karonis, N.; Olson, R.; Overbeek, R.; Pfluger, N.; Price, M.; Tuecke, S. Argonne National Lab., IL (USA). Mathematics and Computer Science Div. Jun 1989. 25p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE89014163/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Molecular biologists have recently developed the technology required to determine the genetic information of complete organisms. They are now faced with a number of interesting computational problems as they attempt to process data. We are interested in developing a software environment to support molecular biologists. As their computational problems are frequently complex and computation-intensive, we believe that such an environment must both support rapid prototyping of new algorithms and allow high performance execution on a variety of multiprocessor configurations. We believe that this can be achieved using a bilingual approach, in which the upper levels of programs are coded in a concurrent logic programming language and the lower levels in C. The concurrent language provides ease of parallel programming and portability over a range of parallel computers; C provides efficient implementation of low-level algorithms. To explore the suitability of this approach, we have investigated its use in attacking a prototypical computational problem, the problem of aligning a set of sequences of genetic material. This report introduces the algorithm used to generate alignments, outlines the techniques used to develop the bilingual program, and describes initial experiments in parallel execution of this program. 7 refs., 2 tabs.

37286 (CONF-8704370–, pp. 3-16) **What transposable elements do in bacteria.** Shapiro, J.A. (Univ. of Chicago, IL (USA)). Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

Transposable elements are well known as agents of genome restructuring and mutagenesis in bacteria. In addition to the widely recognized phenomena of sequence disruption and transcription blocks, their influence on genome functioning comprises multiple positive and negative effects. Some examples of these are detailed: Tn1000 can act at a distance as a transcriptional silencer of the ebgA promoter; IS2 utilizes several kinds of sequence rearrangements to create new promoters; IS1 and IS5 can act as transcriptional enhancers of the existing but poorly expressed β-glucoside (bgl) promoter. Besides having a wide repertoire of mechanisms for altering genome function, the activities of transposable elements display considerable responsiveness to changes in bacterial physiology. Some examples of such responsiveness are detailed: insertions of Tn3, IS1, and IS5 are highly sensitive to the topology of target DNA; phase Mu can mediate the fusion of two different protein coding sequences, and this fusion occurs in a highly regulated manner in response to selection for hybrid protein function. A Mudlac element can block plasmid inheritance, and this inhibitory activity can be programmed to occur at specific times in

colony development. These examples of genomic modulation and physiological responsiveness point to useful roles for transposable elements in facilitating bacterial survival and proliferation.

37287 (CONF-8704370–, pp. 63-70) **Regulation of the maize suppressor-mutator element.** Fedoroff, N. (Carnegie Institution of Washington, Baltimore, MD (USA)); Masson, P.; Banks, J. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

The nature of the regulatory mechanisms governing expression of the transposable maize suppressor-mutator (Spm) element has been deduced from genetic and molecular studies. Small, extensively deleted, transposition-defective Spm (dSpm) elements insert into and near genes in such a way that gene expression is under either the negative or positive control of a separate nondefective element, implying that the element encodes a trans-acting gene product that interacts with element sequences. The properties of the a-m2 Spm insertion alleles of the maize a locus suggest that the element-encoded regulatory mechanism is a positive one. Spm elements also undergo reversible genetic inactivation, possibly by methylation of the element, and there is evidence that the element can exist in two different states of inactivity. One of the inactive states is relatively unstable and readily reversed by the element's positive regulatory function, whereas the other inactive state, termed cryptic, is very stable and can be reversed by the element's positive regulatory function only at a low frequency.

37288 (CONF-8704370–, pp. 71-78) **Functional potential of the human LINE-1 family of interspersed repeats.** Singer, M.F. (National Cancer Institute, Bethesda, MD (USA)); Skowronski, J.; Fanning, T.G.; Mongkolsuk, S. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

LINE-1s (L1s) are likely to be mammalian movable elements that transpose through a mechanism involving an RNA intermediate and an element-encoded reverse transcriptase. Such a mechanism implies the occurrence of L1 transcription and translation. Earlier, the authors identified unit length L1 transcripts in the cytoplasmic, poly(A)$^+$ RNA of a human teratocarcinoma cell line, NTera2D1. The RNAs represent only one L1 strand, the one with long open reading frames (ORFs), and initiate (5' end) with the first residue of the genomic L1 family members. They have now been characterized further by sequence analysis of cDNAs. Although each of 19 cDNAs is slightly different in sequence and, thus, is probably transcribed from a different family member, their overall structures are similar and consistent with the RNAs being intermediates in reverse-transcription-mediated transposition. In the cDNA consensus sequence, an approximately 5-kb reading frame is broken in two (to form a 5' ORF 1 and a 3' ORF 2) by a short region containing two in-frame stop codons. ORF 2 (3852 bp) includes regions that could encode a polypeptide with homology to both reverse transcriptase and a nucleic-acid-binding domain. RNA transcribed from at least one of the cDNAs can be translated in vitro, suggesting that the cDNA represents a functional mRNA.

37289 (CONF-8704370–, pp. 79-90) **Factors affecting retrotransposition of intracisternal A-particle proviral elements.** Kuff, E.L. (National Institutes of Health, Bethesda, MD (USA)). Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

Although intracisternal A-particle (IAP) proviral elements are abundant in the mouse genome, a number of factors restrict their potential for retrotransposition. The most obvious restrictions are imposed by genetic defects in the elements themselves and by the inhibitory effects of genomic methylation. Sequestration of elements in genetically inert heterochromatin may also be a major limiting factor. Even when transcription of competent provirus(es) has been initiated, the location and other properties intrinsic to the particles themselves may hamper reverse transcription and/or integration of provirus. Most of the IAP elements found to be transposed have contained major deletions involving both the gag and pol coding regions; retrotransposition of such elements must depend upon co-expression of competent IAP genes. A number of factors that limit retrotransposition are common to both IAPs and the Ty elements of yeast and may be general mechanisms for maintaining equilibrium between reiterated endogenous transposable elements and their host genome.

37290 (CONF-8704370–, pp. 91-100) **Two families of human endogenous retroviral genomes.** Callahan, R. (National Institutes of Health, Bethesda, MD (USA)). Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

Retroviruses are the causative agents of naturally occurring tumors in diverse vertebrate species. In addition to their spread as infectious agents, they can also enter the germ line and be transmitted to subsequent generations of the host as stable Mendelian genetic elements (endogenous retroviruses, Erv). DNA sequences related to infectious retroviruses from several mammalian and avian species represent approximately 0.1% of the human genome. They are found on many, if not all, of the human chromosomes. These retroviral-related sequences can be divided into two diverse families (designated class I and II) based on their relative homology to either mammalian type C or to types A, B, D, and avian type C retroviral genomes. Some of the human endogenous retroviral (Herv) genomes are organized in a manner expected for an integrated proviral genome; others are present in one of two aberrant structures. Expression of Herv genomes has been detected in normal and tumor tissues, as well as in tissue culture cell lines. Although there is no evidence at the present time that they encoded infectious virus, it seems possible that they could be associated with certain inherited diseases or neoplasias.

37291 (CONF-8704370–, pp. 115-122) **Transposons as probes of regulatory machinery.** Bingham, P.M. (State Univ. of New York, Stony Brook (USA)); Chou, T.; Zachar, Z. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

su(w^a), suppressor-of-white-apricot, is a retrotransposon insertion allele-specific suppressor locus in Drosophila. As such, su(w^a) is a presumptive regulatory gene. The authors review here their studies indicating that su(w^a) expression is autoregulated at the level of splicing. Specifically, the su(w^a) protein product apparently feeds back to block splicing of the first two of the seven introns whose removal is required to produce the message coding for this protein. Implications of these and related observations for mechanisms of regulation of metazoan gene expression are discussed. Furthermore, the authors briefly review prospects for progress resulting from using transposon parasites to probe the regulatory machinery of their cellular hosts.

37292 (CONF-8704370–, pp. 131-144) **Regulation of expression and transposition of murine endogenous retroviral elements.** Wilson, M.C. (Research Institute of Scripps Clinic, La Jolla, CA (USA)); Policastro, P.F.; Fredholm, M. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

The majority of murine leukemia virus (MLV)-related sequences in the murine genome are defective for production of infectious virus

but are transcribed in a variety of tissues. Their transcription is governed by at least two trans-acting genes, Gv-1 and Gv-2, as well as tissue specific factors. Some of these endogenous retroviral transcripts contain deletions of gag-pol and env coding sequence. Oligonucleotide probes spanning these deletions have been used to both isolate Gv-1 responsive genes from murine strain 129 and demonstrate the mobility of these elements among different strains of inbred mice. A target sequence for trans regulation within the long terminal repeats (LTR) of these endogenous sequences, but not in infectious virus, is postulated. The authors propose that the movement of these sequences, mediated by transcription and retrotransposition, may represent mutagenic events within the murine genome.

37293 (CONF-8704370–, pp. 155-168) **Genetic control of recombination between repeated sequences.** Rothstein, R.J. (Columbia Univ. College of Physicians and Surgeons, New York, NY (USA)); Arthur, W.L.; Wallis, J.W. Jr.; Ronne, H.; Thomas, B.J. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

In thinking about genome stability in eukaryotes, it is important to consider the question of the control of recombination between repeated sequences. The genomes of virtually all organisms are filled with repeated sequences. Thus, if there were uncontrolled recombination between these elements, deletions, inversions and translocations would be generated at high frequency. Since this is not observed, it implies that these recombination events may be suppressed. Recent observations in yeast emphasize the importance of this postulated control, since meiotic recombination between homologous sequences in nonhomologous positions (ectopic gene conversion) has been found to occur very near the levels observed for homologous recombination. In this report the authors discuss recombination among repeated sequences including δ-sequences and Ty elements. They will focus on the mechanism of rearrangements that use the host recombination apparatus.

37294 (CONF-8704370–, pp. 183-194) **Regulatory aspects of the expression of P-M hybrid dysgenesis in Drosophila.** Kidwell, M.G. (Univ. of Arizona, Tucson (USA)). Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

The degree of mobility of P elements in Drosophila melanogaster appears to be largely dependent on P-element-encoded properties. Intact, autonomous elements encode a trans-acting transposase and at least some classes of truncated or deleted elements apparently code for regulatory molecules. Transposition is restricted to the germline and is controlled at the level of mRNA splicing. Environmental variables, such as temperature and aging, have important effects on the level of expression of specific phenotypic traits. There is some evidence for variability in host functions affecting P element mobility, but the ease of interspecific transfer suggests that, if such functions exist, they must have been highly conserved during the evolution of the genus Drosophila. Site specificity for P element insertion occurs at several levels, including those of the nucleotide and the individual gene. Secondary mutations usually occur at least one to two orders of magnitude more frequently than primary insertion mutations. Studies of the evolution and population biology of P elements are providing valuable insights into the role of element-encoded regulatory functions in natural and laboratory populations.

37295 (CONF-8704370–, pp. 235-244) **Effect of temperature on Ty transposition.** Paquin, C.E. (Univ. of Cincinnati, OH (USA)); Williamson, V.M. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

A method of estimating the transposition rate of the transposable element Ty (transposon yeast) in the yeast Saccharomyces cerevisiae has been developed. The transposition assay is based on the altered expression of two alcohol dehydrogenase (ADH) structural genes, ADH2 and ADH4, upon insertion of a Ty adjacent to these genes. Ty transposition to both ADH2 and ADH4 is 100-fold more frequent at 15°C or 20°C than at 30°C, the optimum growth temperature for S. cerevisiae. These results demonstrate that transposition rates can be dramatically altered by changes in environmental conditions.

37296 (CONF-8704370–, pp. 299-308) **Retrovirus-like particles, reoviruses, and c-src expression in malignant tumors of Drosophila melanogaster.** Gateff, E. (Johannes Gutenberg Univ., Mainz (West Germany)). Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

Mutated, recessive differentiation genes of Drosophila melanogaster cause malignant transformation of specific tissues and cell types in homozygous mutant animals. Retrovirus-like particles (RLPs; previously virus-like particles, VLPs) were regularly observed in mutant tumor cells. The presence of RLPs and copia transcripts was studied in the tumorous lethal(2)giant larvae (l(2)gl) neuroblasts in situ and after transplantation in adult abdomens. Neither RLPs nor copia transcripts were detected in the mutant neuroblasts in situ. However, large amounts of copia transcripts were found in RLPs from l(2)gl neuroblasts subcultured in the abdomens of wild-type flies. Karyotypic abnormalities increased dramatically with each new transfer generation in subculture in vivo. Moderate amounts of RLPs were also found in the blood cells in situ in two blood tumor mutants: lethal(a)malignant blood cell neoplasm, l(1)mbn, and lethal(3)malignant blood cell neoplasm, l(3)mbn. The number of RLPs increased drastically after in vitro subculture of l(3)mbn blood cells and the blood cells of the mutant lethal(2)malignant blood neoplasm, l(2)mbn. In addition to large amounts of RLPs, a new respiratory enteric orphan virus (reovirus) designated as Drosophila F virus (DFV) and a well-known picorna virus, the Drosophila C virus (DCV), were found in in-vitro-subcultured l(2)mbn and l(3)mbn blood cells. Compared to the tumorous blood cells in situ, the in-vitro-subcultured blood cells showed slightly elevated c-src expression.

37297 Structural studies of Klenow fragment: an enzyme with two active sites. Steitz, T.A. (Yale Univ., New Haven, CT (USA)); Beese, L.; Freemont, P.S.; Friedman, J.M.; Sanderson, M.R. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, NY, USA; Jul 1987.

Among the catalytic activities that were presumably required very early in evolution is that of RNA and/or DNA polymerase. The ability to replicate the nucleic acid genome accurately is essential to the process of evolution. One might expect that the basic polymerase function of the present-day DNA polymerases evolved from a common ancestor, since an intermediate evolutionary state of switching from one polymerase to another is difficult to imagine. It may even turn out that RNA and DNA polymerases are evolutionarily and thus structurally related. A detailed understanding of the enzymatic mechanism of current DNA and RNA polymerases might or might not provide clues concerning the possible nature of earlier prebiotic RNA polymerases. The crystal structure of the Klenow fragment shows that the 605-amino-acid polypeptide is folded into two distinct structural domains of approximately 200 and 400 amino acids. The amino terminal one third of the Klenow fragment can bind two divalent metal ions and a molecule of dNMP. The larger carboxy-terminal domain forms a structure that contains a deep cleft, about 20-24 Å wide and 25-35 Å deep. Above the cleft are 40 to 50 amino acid residues that are partially disordered in the crystal structure, indicating that this region is flexibly attached to the rest of the molecule.

37298 (DOE/ER/60623–1) **A soliton mechanism for DNA melting: Progress report, November 1, 1988–October 31, 1989.**

Sobell, H.M. Rochester Univ., NY (USA). Dept. of Biophysics. Jun 1989. 2p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER60623. Order Number DE89013967/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A key feature of the soliton mechanism for DNA melting that has been proposed is the existence of an activated metastable DNA conformational state called β-DNA. Being metastable, this DNA conformation must be "pinned" or stabilized by an intercalating drug molecule such as actinomycin D in order to be observed. We have synthesized a series dodecamer oligonucleotide fragments, and have succeeded in forming crystalline complexes with actinomycin D. Their x-ray determination should allow atomic resolution and clarify how actinomycin binds to DNA. This will allow us to prove (or disprove) the actinomycin-DNA model we have proposed.

37299 (INIS-mf–11950) **Development of radioimmunological methods to determine the constituents of nicotiana plants and cell cultures.** Kolossa, E. Muenchen Univ. (Germany, F.R.). Fakultaet fuer Chemie und Pharmazie. 20 Dec 1983. 220p. (In German). Order Number DE89788270/JAW. Available from NTIS (US Sales Only), PC A10/MF A01.

This study outlines the technique, optimisation and range of uses of radioimmunoassays for nicotine as well as α-cembratriendiol and β-cembratriendiol, which due to their specificity are suitable for relevant detection procedures in non-purified raw extracts from plants. The tests are characterised by high accuracy (with an intra-assay variance between 3.3 and 4.5% and an interassay variance between 12 and 17%) and sensitivity (the limits of detection being 0.5 ng for nicotine, 1 ng for α-cembratriendiol and 3 ng for β-cembratriendiol) and easy enough to handle to permit quantitative determination of 800 samples per day and person.

37300 (SAND–89-1145C) **Quantitative infrared spectroscopy of glucose in blood using partial least-squares analyses.** Ward, K.J.; Haaland, D.M.; Robinson, M.R.; Eaton, R.P. Sandia National Labs., Albuquerque, NM (USA). 1989. 11p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890674–1: 7. international conference on Fourier transform spectroscopy, Fairfax, Virginia, USA, 19-23 Jun 1989). Order Number DE89014706/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The concentration of glucose in drawn samples of human blood has been determined using attenuated total reflectance (ATR) Fourier transform infrared (FT-IR) spectroscopy and partial least-squares (PLS) multivariate calibration. A twelve sample calibration set over the physiological glucose range of 50-400 mg/deciliter (dl) resulted in an average error of 5.2 mg/dl. These results were obtained using a cross validated PLS calibration over all infrared data in the frequency range of 950-1200 cm^{-1}. These results are a dramatic improvement relative to those obtained by previous studies of this system using univariate peak height analyses. 3 refs., 3 figs.

5503 Cytology

Refer also to citation(s) 37251

37301 (AD-A–204745/4/XAB) **Molecular basis of RNA catalysis. Annual report, March 1988-February 1989.** Turner, D.H. Rochester Univ., NY (USA). 15 Feb 1989. 3p. Available from NTIS, PC A02/MF A01.

This project involves kinetic studies of RNA splicing reactions catalyzed by the intervening sequence from the precursor rRNA of Tetrahymena thermophila. Fluorescent substrates were developed that can be used for transient kinetics experiments. The ultimate goal is identification and understanding of each step in the mechanism for splicing.

37302 (PB–89-158752/XAB) **Recombinant DNA in Japan: current status and future prospects.** Department of Commerce, Washington, DC (USA). Office of Japanese Technical Literature. 1989. 147p. Available from NTIS, PC EE06/MF A01.

The goals of the report are to evaluate the current status of Japanese Recombinant DNA Biotechnology, and to suggest ways to improve the use of the Japanese biotechnology literature. Abstracts and titles of papers presented at Japanese scientific meetings held from November 1987 to November 1988 were evaluated and translated to give the reader an overall idea of the areas in which Japanese researchers are active. In general, Japanese recombinant DNA technology is on a par with that in the U.S. - there is no technology lead on either side. The author recommends that U.S. bio-researchers should read the Japanese language literature, particularly in applied areas, since the abstracts of meetings held in Japan in Japanese are a good source of current, concise information.

37303 (UCRL–52000-89-4) **Energy and Technology Review.** Poggio, A.J.; Mayall, B.H. (eds.). Lawrence Livermore National Lab., CA (USA). Apr 1989. 27p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89013919/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Lawrence Livermore National Laboratory (LLNL) is an acknowledged world center for analytical cytology. This leadership was recognized by the Regents of the University of California (UC), who in 1982 established and funded the Program for Analytical Cytology to facilitate the transfer of this technology from scientists at LLNL to their University colleagues, primarily through innovative collaborative research. This issue of Energy and Technology Review describes three of the forty projects that have been funded in this way; chosen to illustrate the potential medical application of the research. Analytical cytology is a relatively new field of biomedical research that is increasingly being applied in clinical medicine. It has been particularly important in unraveling the complexities of the human immune system and in quantifying the pathobiology of malignancy. Defined as the characterization and measurement of cells and cellular constituents for biological and medical purposes, analytical cytology bridges the gap between the quantitative discipline of molecular biology and the more qualitative disciplines of anatomy and pathology. It is itself multidisciplinary in nature. Two major approaches to analytical cytology are flow cytometry and image cytometry. In each of these research techniques, cells are measured one at a time in an automated device. In flow instruments, the cells are dispersed in fluid suspension and pass in single file through a beam of laser light to generate optical signals that are measured. In image cytometry, cells are dispersed on a slide and are imaged through a microscope onto an electronic imaging and analysis system that processes the cell image to extract measurements of interest.

5504 Genetics

Refer also to citation(s) 37287, 37288, 37292, 37293

37304 (CONF-8704370–, pp. 17-28) **Role of the bacterial host in the mechanism and regulation of Tn10 transposition.** Roberts, D. (Harvard Univ., Cambridge, MA (USA)); Morisato, D.; Kleckner, N. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

Transposon Tn10 can promote a variety of genetic alterations in Escherichia coli, including insertion mutations, chromosomal deletions, and chromosomal rearrangements. The authors describe below several ways in which the occurrence of these Tn10- and IS10-promoted events is under control of the host cell. First, DNA methylation by the host enzyme dam methylase reduces transposase expression. Second, methylation prevents transposase action at inner termini. Third, host-DNA-binding proteins integration host factor (IHF) and/or hemagglutinating unit (HU) are necessary for transposase action at the outer termini. Finally, the authors present evidence that the host cell responds to transposition by induction of a λ prophage and hence, probably, the cellular SOS system.

37305 (CONF-8704370–, pp. 41-50) **Mobile DNA elements and spontaneous gene mutation.** Green, M.M. (Univ. of California, Davis (USA)). Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order

Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

The molecular genetic analysis of presumptive spontaneous mutations in Drosophila melanogaster demonstrates an inordinate fraction to be causally associated with inserts of mobile DNA elements. The operational definition of spontaneous mutation as an autonomous event is examined in the context of those genetical-environmental conditions that drive mobile DNA elements.

37306 (CONF-8704370–, pp. 51-62) **Molecular genetic studies of the mouse dilute locus: analysis of two dilute alleles and dilute-suppressor.** Strobel, M.C. (NCI-Frederick Cancer Research Facility, MD (USA)); Seperack, P.K.; Moore, K.J.; Copeland, N.G.; Jenkins, N.A. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

The original mouse dilute mutation (d) was identified solely by its variant coat color. However, most other d alleles manifest the additional phenotypes of neurological disorders and juvenile lethality. The over 200 alleles at the dilute locus provide a strong genetic basis for the molecular analysis, which will allow a correlation between these phenotypes and expression patterns of the genomic d locus. Initial studies have focused on two d mutations, the original d and a dilute-lethal allele, d^{120J}. The original d mutation, now termed dilute-viral or d^{v}, is causally associated with an ecotropic murine leukemia provirus, Emv-3, whereas the d^{120J} mutation is correlated with a small deletion. Analysis of germline and somatic d^{+} revertants of d^{v} has elucidated the probable mechanism by which proviral excision causes phenotypic reversion. Together, d^{v} and d^{120J} have provided molecular entree to the genomic d locus, allowing the initial identification of dilute transcripts. Finally, the effect of dilute-suppressor (dsu), an unlinked, semidominant mutation that suppresses the dilute coat color defect of d^{v}, on the d^{120J} allele has been examined. These studies have allowed a hypothesis to be drawn concerning the mechanism of suppression by dsu.

37307 (CONF-8704370–, pp. 103-114) **Concerted transposition in Drosophila melanogaster.** Tchurikov, N.A. (N.K. Koltsov Institute of Developmental Biology, Moscow (USSR)); Gerasimova, T.I.; Georgieva, S.G.; Mizrokhi, I.J.; Georgiev, P.G.; Ilyin, Y.V. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

The authors studied the molecular nature of mutations occurring during transposition explosions in Drosophila melanogaster. Besides mobile element excisions and long terminal repeat (LTR)-targeted reinsertions, deletion mutations of single-copy gene sequences and their reversions to the wild type were observed. The characteristic sets of mutation changes were shown to appear independently in certain strains. Such simultaneous multiple transposition events were demonstrated in the cut (ct) and white (w) loci. The possible mechanisms of the described events are discussed.

37308 (CONF-8704370–, pp. 123-130) **Molecular basis of transposable element-induced mutations in Drosophila melanogaster.** Geyer, P.K. (Johns Hopkins Univ., Baltimore, MD (USA)); Green, M.M.; Corces, V.G. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

In order to understand the mechanisms underlying the mutagenic effect of the gypsy transposable element, the authors carried out a detailed structural and functional analysis of the yellow (y) locus in wild-type flies, in the gypsy-induced allele y^{2}, and several phenotypic revertants. The complex pattern of temporal and spatial expression of the yellow gene is controlled by four distinct and independent regulatory elements. Sequence analysis of y^{2} revertants suggests that the phenotype of the gypsy-induced allele is not due to the integration of the transposon into regulatory sequences, or distancing of these sequences from the TATA box, but rather to the interaction between transcriptional regulatory elements located in gypsy and the yellow control regions responsible for the proper expression of this gene in the affected tissues.

37309 (CONF-8704370–, pp. 145-153) **Genes that affect Ty-mediated gene expression in yeast.** Winston, F. (Harvard Medical School, Boston, MA (USA)). Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

Ty and solo δ insertion mutations in the 5' noncoding regions of genes in Saccharomyces cerevisiae can inhibit adjacent gene expression. Frequently, this occurs because transcription signals on the Ty or δ interfere with those of the adjacent gene. Trans-acting suppressors of Ty and δ insertion mutations are candidates for mutations in genes that encode transcription factors that are required for the function of Ty transcription signals. The authors have isolated and analyzed a large number of suppressors of Ty and δ insertion mutations and have identified eight new genes. Mutations in these genes alter transcription of genes adjacent to Ty and δ insertion mutations. In addition, they frequently cause other mutant phenotypes, suggesting that they may also be important for more general cellular functions.

37310 (CONF-8704370–, pp. 169-180) **Regulation of yeast Ty element transposition.** Boeke, J.D. (Johns Hopkins Univ. School of Medicine, Baltimore, MD (USA)); Eichinger, D.; Fink, G.R. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

Yeast Ty elements transpose via a retrovirus-like mechanism. They are responsible for causing a variety of spontaneous mutations; systems in which the frequency of these events is greatly elevated are very useful for the study of the retrotransposition process. At least one gene, SPT3, encoded by yeast, regulates the transcription of, and hence the transposition of, Ty elements. During transposition, Ty element sequences apparently recombine with each other to generate hybrid elements. Such recombinational processes may be important in shuffling Ty promoters of various strengths in front of either functional or nonfunctional Ty coding sequences. The authors have analyzed the molecular nature of the defect in one such nonfunctional Ty element.

37311 (CONF-8704370–, pp. 209-216) **Structure of mutations induced by I-R hybrid dysgenesis in Drosophila melanogaster.** Finnegan, D.J. (King's Buildings, Edinburgh (England)); Busseau, I.; Lynch, M.; Fawcett, D.H.; Lister, C.K.; Pelisson, A.; Sang, H.M.; Bucheton, A. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

Transposable elements with a sequence organization similar to that of I elements are found in a wide range of organisms. These include L1 elements in mammals, F and G elements in D. melanogaster, and an element called ingi found in the genome of Trypanosoma brucei. The Doc and jockey sequences of D. melanogaster may also be elements of this type. The authors have shown that I elements can cause mutations by inserting into genes and can be responsible for gross rearrangements of adjacent sequences. The frequency with which these events take place is low in I strains but is greatly increased when complete I factors are expressed at high levels under conditions of I-R hybrid dysgenesis. This raises the possibility that other elements of this type may produce similar genomic changes and that these might make a significant contribution to mutation frequencies if expression of functional elements were to be stimulated by outcrossing or other forms of genomic shock.

37312 (CONF-8704370–, pp. 219-234) **Evidence of host-mediated regulation of retroviral element expression at the posttranscriptional level.** McDonald, J.F. (Univ. of Georgia, Athens (USA)); Strand, D.J.; Brown, M.R.; Paskewitz, S.M.; Csink, A.K.; Voss, S.H. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

The authors study of copia, RSV, and HIV LTR expression in Drosophila, murine, and human cells, as well as their survey of copia tissue-specific expression over Drosophila development, suggest that a significant component of the host-mediated trans-regulatory control of retroviral element expression occurs on the posttranscriptional level. Interestingly, posttranscriptional regulation is emerging as an important component of eukaryotic gene expression in general. The developing consensus is that eukaryotic gene expression is a coordinated process, involving a complex of cell- and stage-specific factors that exert their regulatory effects at multiple levels. Since retroviral element expression appears to be mediated by pre-established, host-encoded regulatory networks, it is perhaps not surprising that the underlying molecular mechanisms also involve multiple levels of gene control.

37313 (CONF-8704370–, pp. 275-286) **DNA modification of Mu elements in maize.** Chandler, V.L. (Univ. of Oregon, Eugene (USA)). Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

The increased mutation rate in Mutator stocks of maize is associated with the transposition of Mu elements. The high mutation rate is heritable, although Mutator stocks occasionally lose their mutagenic activity. Southern blot analysis of Mu elements demonstrates a correlation between loss of activity and an inhibition of digestion of Mu elements by methylation-sensitive restriction enzymes. This modification is stable through several generations of out-crosses. Most stocks of maize are non-Mutator, yet they usually contain a few copies of intact Mu elements. The authors have characterized an intact Mul-like element from the non-Mutator line B37 that is identical to Mul, an element known to transpose in Mutator stocks. In B37 genomic DNA this element is modified such that certain methylation-sensitive restriction enzymes will not cut it. Modification of this element is lost when it is placed in an active Mutator stock by genetic crosses. They hypothesize that DNA modification of transposable elements may serve as a heritable, but potentially reversible, mechanism for regulating transposable elements. One source of genomic instability may be the liberation of transposable elements through the demethylation of cryptic elements.

37314 (CONF-8901130–1) **Genetics of early embryo survival.** Niswander, L.; Edstroem, J.E.; Rinchik, E.M.; Magnuson, T. Oak Ridge National Lab., TN (USA). 1989. 10p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From UCLA symposia on molecular and cellular biology: transgenic models in medicine and agriculture; Taos, NM, USA; 28 Jan - 3 feb 1989. Order Number DE89013053/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The albino-deletion complex represents one of the few regions of the mouse genome where a set of specific developmental defects are associated with a series of overlapping chromosomal deletions. A total of 37 deletions exist, all of which remove the region of mouse chromosome 7 that surrounds and includes the albino coat-color locus. The complementation patterns among these deletion chromosomes indicate that at least 9 distinct functional units exist in this region. Two of these units contain genes whose expression is required around the time the basic body plan is being established in the early postimplantation embryo. Embryos homozygous for the deletions that remove one of these units develop to day 8.5. Extensive development of the extraembryonic structures occurs, and the three primary germ layers form but there is no organization of mesoderm into somites or induction of the neural axis. Embryos homozygous for deletions that remove the second region, as well as the first, do not undergo gastrulation, and there is no development of the extraembryonic structures. 10 refs., 2 figs., 1 tab.

37315 (Juel–2249) **Construction of an expression vector for the gram-negative bacterium Zymomonas mobilis.** Reynen, M. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Biotechnologie; Duesseldorf Univ. (Germany, F.R.). Dec 1988. 129p. (In German). Order Number DE89788398/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

The gram-negative bacterium Z.mobilis offers a considerable potential for industrial ethanol production. But till now, not a single commercially interesting process has been established, because of the limited substrate range of the organism. All attempts to enlarge the substrate range by means of molecular genetics failed. Reasons are, the small number of suitable vectors for Z.mobilis, the lack of a transformation system and the often poor expression of heterologous genes in this microorganism. In this work the Pyruvate Decarboxylase gene (pdc) originated from Z.mobilis ATCC29191 has been characterized and the promoter region was used for the construction of an expression vector for Z.mobilis.

5505 Metabolism

Refer also to citation(s) 35901, 35905, 36428, 37253, 37320, 37326, 37376, 37396

5506 Medicine

Refer also to citation(s) 37035, 37300, 37355

37316 (IAEA-R–3695-F) **Israel EQAS for thyroid related hormones. Final report for the period June 1984 - February 1988.** Kahana, L. Carmel Hospital, Haifa (Israel). Inst. of Endocrinology; International Atomic Energy Agency, Vienna (Austria). Oct 1988. 35p. Order Number DE89618050/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

An External Quality Assessment Scheme (EQAS) for thyroxine (T_4), triiodothyronine (T_3) thyroid stimulating hormone (TSH) and free thyroxine (FT_4) radioimmunoassay (RIA) was operated in 36 laboratories. The 17 serum pools distributed covered analyte concentrations from subnormal to elevated values. Five of these were based on "zero analyte" pools artificially prepared by treatment with Amberlite. "Spiked" sera was used for recovery studies. Eleven pools were analyzed more than once. Abnormal, method dependent results with large interlaboratory variation was observed in the Amberlite treated pools. A "matrix effect' was suspected and the results excluded from analysis. The All Laboratory Trimmed Mean (ALTM) was stable to within 4% for each analyte and taken as target value. Overall recovery for T_3, T_4, and TSH was 101, 91, and 89 per cent. Laboratory performance was assessed from the bias of each result and the variability of bias (as CV of bias for each test), over one year. Performance has improved, especially for TSH, where median bias decreased to 1% from 39%. Percentage of laboratories with unacceptable performance fell from 79% to 32%. A trend towards increased use of IRMA for TSH and of F-T_4 was observed. However, F-T_4 results proved method dependent. TSH IRMA is suggested as the best supplementary test to T_4 for thyroid function testing. Refs, figs and tabs.

37317 (INIS-mf–11404 S65) **New possibilities and aspects of NMR diagnosis by ultralow field NMR imaging.** Groenemeyer, D.H. (Krankenhaus Institut, Muelheim an der Ruhr (Germany, F.R.)); Seibel, R.M.; Kaufmann, L.; Crooks, L. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

NMR IMAGING/optimization; IMAGE PROCESSING; OPTIMIZATION

37318 (INIS-mf–11957) **UW 21/123 monoclonal antibody in the radioimmunological detection of tumour tissue in the head and neck region.** Mueller, N. Wuerzburg Univ. (Germany, F.R.).

Medizinische Fakultaet. 26 May 1987. 101p. (In German). Order Number DE89788203/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

When incorporated in a radioimmunoassay the UW 21/123 the monoclonal antibody permits the diagnosis of certain squamous cell carcinoma of the cephalocervical region and is particularly reliable in the detection laryngeal carcinomas. It even permits the assessment of tumour cells that are not yet fully developed and thus still escape histological detection. (MBC).

37319 (INIS-SU–85, pp. 79-86) **On incompleteness of interpretation rules for some diagnostic images.** Agranat, V.Z.; Ryabov, O.L.; Sokolov, B.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Nuclear reactor physics and technology. Scientific-technical collection.* Order Number DE89012154/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

The sources of interpretation deadlock arisen after mathematical treatment of a great number of liver radioisotope images are examined within a scheme proposed by authors. It turned out that in the framework of the rules currently in force for data interpretation all examined patients without exception should considered sick. This conclusion was rejected for many reasons including the lack of any evidences that the results of treatment are correct. The results obtained made it possible to reject the assumption about nonorgan nature of detected traces and thereby to reveal an excessive simplicity of the current rules of making diagnostic conclusion. 5 refs.; 12 figs.

37320 (ORNL/TM–11145) **Nuclear Medicine Program progress report for quarter ending December 31, 1988.** Knapp, F.F. Jr.; Ambrose, K.R.; Callahan, A.P.; McPherson, D.W.; Srivastava, P.C.; Allred, J.F.; Blystone, S.L.; Kropp, J.; Lisic, E.C.; Rice, D.E. Oak Ridge National Lab., TN (USA). Jun 1989. 13p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89013758/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A new project involving the development of production and processing technology for radionuclides of biomedical interest has been initiated in the Nuclear Medicine Program. This research supports the development of radioisotope production and processing technology and radionuclide generator systems to provide the technology required to make available radionuclides of biomedical interest. The principal focus is the evaluation of radioisotope reactor production modes, radiochemistry, and radioanalytical methods to provide radionuclides of high specific activity and radiochemical purity. This project complements the Nuclear Medicine and core Biomedical Radioisotope Technology Program which involves the design, development, and biological testing of new tissue-specific radiopharmaceuticals. The goal is to expand the capability at ORNL to produce medical radionuclides that are not commercially available using state-of-the-art technology. This project is not a production effort but a research and development activity to assess and solve problems associated with the production, processing, and availability of radionuclides of medical interest. The synthesis of 15-(p-iodophenyl)-3-R, S-methyl-3-hyroxypentadecanioc acid (3-hydroxy BMIPP) is also described in this report. Comparison of the chromatographic properties of the polar metabolite isolated rat hearts administered iodine-125 BMIPP have demonstrated it to be more polar than 3-hydroxy BMIPP.

37321 (PB–89-173579/XAB) **Radiology PRICER 2.0 subroutines for RADMAIN and RADPRICE. Software.** Kowaleski, R. Health Care Financing Administration, Baltimore, MD (USA). Bureau of Program Operations. 1 Apr 1989. mag ta Available from NTISCP T05.

Source tape is in the EBCDIC character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. For price at 6250 bpi density, call NTIS Computer Products. Price includes documentation, PB–89-173587.

RADMAIN is a driver program provided for installation testing of PRICER 2.0. The format of the tape accompanying the form is 6250-BPI, 9-track, standard-label multifile tape. The six files contained on the tape are: RADMAIN - Driver program - COBOL vs source code; RADPRICE - Radiology Pricing subroutine; RADPROV - COBOL vs source code - Providers with carriers and localities; RADHCPCS - Radiology HCPCS codes; RADPREV - Prevailing charges and Fee Schedule amounts for Radiology; BILL - Radiology Bill Test File. Software Description: The software is written in the COBOL language for use on IBM 3090-500E using XA operating system.

37322 (PB–89-173587/XAB) **Radiology PRICER 2.0 subroutine installation guide, Volume 1 and Volume 2.** Kowaleski, R. Health Care Financing Administration, Baltimore, MD (USA). Bureau of Program Operations. 1 Apr 1989. 94p. Available from NTIS, PC A05/MF A01.

For system on magnetic tape, see PB–89-173579.

Radiology pricing subroutine (PRICER 2.0) is furnished by the Health Care Financing Administration to process the payment of Outpatient Medicare claims with discharges on or after April 1, 1989. Volumes 1 and 2 contain the installation and operation guidelines necessary to install PRICER 2.0 in an IBM 3090 environment. The installation requires that the receiver be familiar with COBOL/VS, OS JCL, and that an interface module has been previously installed. The installation tape contains the program source code and data files necessary to completely install Radiology PRICER 2.0. Volume 2 contains Appendix A through G: Appendix A - RADMAIN (driver) source listing; Appendix B - RADPRICE source listing; Appendix C - listing of the Provider File; Appendix D - listing of the HCPCS Code File; Appendix E - listing of the Prevailing Charge/Fee Schedule File; Appendix F - listing of the bill test file; Appendix G - listing of the expected test results.

37323 (PB–89-860688/XAB) **Computerized tomography: technology and equipment. January 1977-February 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1977-February 1988.** National Technical Information Service, Springfield, VA (USA). May 1989. 185p. Available from NTISPC N01/MF N01.

See also PB–89-860696.

This bibliography contains citations concerning the instrumentation, technology, and applications of computerized tomography (CT). Production-model CT scanners are compared and evaluated for noise, spatial resolution, axial position sensitivity, artifact, and dose. Research and development efforts of equipment and applications are discussed. (This updated bibliography contains 377 citations, none of which are new entries to the previous edition.)

5507 Microbiology

Refer also to citation(s) 35519, 35520, 35528, 35905, 36428, 37315, 37339

37324 (DOE/ER/13278–2) **Detection and characterization of novel metal-binding proteins: Final report.** Holmes, D.S.; Leib, T.K. General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center. Dec 1988. 45p. Sponsored by DOE Energy Research. DOE Contract FG02-84ER13278. Order Number DE89013968/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The research proposed and carried out under this grant concerned the detection and characterization of novel metal-binding proteins. In particular, the research goals as outlined in the original proposal were to detect novel metalloproteins from unusual bacteria such as Thiobacillus and Sulfolobus, to characterize one or more such novel metal-binding proteins, and, as a long-range goal beyond the scope of the proposal, to explore the conditions necessary for an industrial or scientific application of metal-binding proteins and to determine its relative advantages and limitations for the proposed application. An important part of this research involved the development of techniques that would enable us to examine the proteins of bacteria for the presence of novel metal-binding proteins. Since many metal-binding proteins are rich in cysteine, we placed emphasis on techniques that would detect cysteine in proteins. While synthesizing metal-binding polypeptides for use as models in the examination of detection techniques, we initiated a study of synthetic metal-binding proteins. We have synthesized and

characterized a family of novel, artificial metal-binding proteins whose structure is based upon naturally occurring metallothionein. Metallothionein has two important properties that make it suitable for industrial applications: very high affinities for several metals including some heavy metals and strategic metals, and exquisite specificity of metal binding. In summary, with this grant we have initiated a study of novel metal-binding proteins and the sulfur-based chemistry that these proteins use to chelate metals. Although we were unsuccessful in detecting new metal-binding proteins in microorganisms, we were able to synthesize and characterize a family of novel, artificial metal-binding proteins whose structure is based upon naturally occurring metallothionein.

37325 (DOE/ER/13339–5) **Respiratory enzymes of Thiobacillus ferrooxidans: Progress report, March 1988–July 1989.** Robert Blake II. Meharry Medical Coll., Nashville (USA). Dept. of Biochemistry. 1989. 10p. Sponsored by DOE Energy Research. DOE Contract FG05-85ER13339. Order Number DE89011526/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Research is described in the following two areas: (1) purification and characterization of the acid stable cytochrome c in crude extracts of T. ferroxidans that catalyzes the Fe(II)-dependent reduction of rusticyanin; (2) purification of the rusticyanin- like proteins from Leptospirillum ferroxidans, and to conduct a spectrophotometric investigation of the electron transfer reactions between soluble iron and the purified protein. (CBS)

37326 (DOE/ER/60556–T1) **[Comparison of the activity of subsurface and surface microorganisms and their anaerobic transformation of heterocyclic compounds]: Progress report, July 1, 1987–June 30, 1989.** Pennsylvania State Univ., University Park, PA (USA). 1989. 14p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER60556. Order Number DE89014435/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Two areas of research are reported on: (1) comparison of the activity of subsurface and surface microorganisms and their anaerobic transformation of heterocyclic compounds; and (2) determination of factors which affect anaerobic microbial activity in the deep subsurface (fourth hole of the Savannah River Plant). In relation to (1) above, experiments were conducted with indole, oxindole, and pyridine under methanogenic and denitrifying conditions. In relation to (2), aerobic and anaerobic conditions of degradation are discussed. (CBS)

5508 Morphology

37327 **Reexamination of the use of otolith nuclear dimensions to identify juvenile anadromous and nonanadromous rainbow trout, Salmo Gairdneri.** *Fishery Bulletin (USA),* 86(1): 160-163 (Jan 1988).

Otoliths are a potential source of taxonomic characteristics for identifying stocks of fish. Differences in dimensions of the otolith nucleus have provided a basis for separating winter from summer races of steelhead, anadromous rainbow trout, Salmo gairdneri. Consequently, to determine whether juveniles of the two forms could be distinguished by differences in dimensions of otolith nuclei, we measured the nuclei in sagittae from steelhead and resident rainbow trout collected from the same Deschutes River, Oregon, locations used by Rybock et al. (1975). We used the definitions proposed by Rybock et al. and by Neilson et al. (1985), and compared our measurements for the two forms with each other and with published values.

5509 Pathology

Refer also to citation(s) 37290, 37296, 37331, 37332, 37389

37328 (AD-A–205007/8/XAB) **Characterization of chemically tritiated microcystin-Lr and its distribution in mouse. Interim report.** Robinson, N.A.; Miura, G.A.; Matson, C.F.; Dinterman, R.E.; Pace, J.G. Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD (USA). 14 Feb 1989. 23p. Available from NTIS, PC A03/MF A01.

Chemically tritiated microcystin-LR (specific activity 194 mCi/mmol), purified to 95% by C-18 reverse-phase HPLC, exhibited the same retention time and ultraviolet absorption profile as unlabeled toxin. Acid-hydrolyzed ^3H toxin yielded tritiated glutamate and beta-methylasparate. Stability of the nonexchangeable ^3H toxin in saline and urine was 93% after 42 days stored at 22, 4, or -20 C. In blood the breakdown of toxin was temperature- and time-dependent (63% at 22 C, 28 days). Unlabled toxin was stable for 42 days stored at either 4 or -20 C in saline. The LD 50 (mouse, i.p.) of ^3H microcystin-LR & unlabeled toxin was the same (75 micrograms/kg 65-90 & 65 micrograms/kg 53-80, respectively). From 3-90 min after i.p. injection of 70 micrograms/kg (3)H microcystin-LR there was a slow absorption of toxin from the peritoneal cavity & efficient accumulation in liver. The elimination half-life of the plasma concentration curve was 29 min. Tritium distribution in tissue at death or 6 hr post injection was similar for all doses (13-101 ug/kg). At 101 micrograms/kg, liver contained 56 plus or minus 1%, intestine 7 plus or minus 1%, kidney 0.9 plus or minus 0.2% & carcass 10 plus or minus 1% of the injected dose. Heart, spleen, lung and skeletal muscle contained < 1% of the radiolabel.

37329 (CONF-8704370–, pp. 309-318) **HTLV-I, HIV, and human T cell growth.** Greene, W.C. (Duke Univ. School of Medicine, Durham, NC (USA)); Dukovich, M.; Wano, Y.; Siekevitz, M. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

The biological effects of human T-lymphotropic virus type I (HTLV-I) and human immunodeficiency virus (HIV) retroviral infection on interleukin 2 (IL-2) and IL-2 receptor gene expression in human CD4$^+$ T cells were studied. The HTLV-I-derived transactivator gene product (tat I), was shown to stimulate the cellular promoter regulating IL-2 receptor (Tac) gene expression and to provide one of the two mitogenic signals required for activation of the IL-2 promoter. In viable CD4$^+$T cells infected with HIV, this virus does not alter mitogen-induced IL-2 receptor gene expression but does markedly inhibit IL-2 gene activation. The lack of production of this growth factor, which is required for the growth of CD4$^+$ T cells, may contribute to the cytopathic effects of this retrovirus and play a role in the progressive depletion of the CD4$^+$ subset of T cells observed in AIDS. Additional studies of CD4$^+$ T cells latently infected with HIV have revealed that mitogenic activation of these cells triggers HIV gene replication. This response appears to reflect properties encoded by the viral long terminal repeat (LTR), as four different types of T-cell mitogens were shown to be capable of activating this viral element. Deletion analysis of the HIV LTR has permitted identification of important positive and negative regulatory sequences that modulate the overall level of viral gene expression following mitogen stimulation.

5520 Public Health

Refer also to citation(s) 37179, 37180, 37182, 37183, 37184, 37185, 37186, 37191

37330 (PB–89-168140/XAB) **Hazard Communication Project: reference manual.** Human Technology, Inc., McLean, VA (USA). Mar 1989. 201p. Available from NTIS, PC A10/MF A01.

For system on diskette, see PB–89-168132.

This reference manual covers the following course objectives: to inform employees of their employer's requirements under the OSHA Hazard Communication Standard (29 CFR 1910.1200); to instruct employees on the procedures for obtaining and using information on hazardous materials, including understanding labeling systems and the material safety data sheet (MSDS) information; to provide information on 11 classes of chemicals, including their common uses, potential physical and health hazards, detection methods, and safety measures to follow. There are 14 lessons, ranging in length from 30 minutes to 1 (one) hour. The lessons are contained on 6 disks that are programmed to run on an IBM-compatible PC with an EGA graphics card and monitor. The program will not run on monochrome or CGA systems.

37331 (PB–89-860191/XAB) **Lead: occupational health hazards. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 45p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning the health hazards of working with lead containing material and processes. Health-hazard evaluations of lead exposure in industrial settings such as resource-recovery plants, iron foundries, lead-ore processing plants, mines, scrap-metal processing plants and yards, tanning facilities, and printing facilities are included. Clinical studies of worker exposure to lead are presented. Occupational Health and Safety Association lead standards are discussed with regard to abatement procedures for lead exposure in the workplace. (Contains 65 citations fully indexed and including a title list.)

37332 (PB–89-860621/XAB) **Lead pollution: public health hazards and environmental toxicity. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989.** National Technical Information Service, Springfield, VA (USA). May 1989. 95p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning the effects of exposure to lead on public health and environmental toxicity of lead pollution. Environmental exposure to lead is discussed with relation to proximity to lead-processing facilities, roadways, industry that produces lead-contaminated emissions, lead-based paints , landfill leachates, and other anthropogenic sources. Toxicity of lead on both humans and natural ecosystems is included. Lead from automotive-fuel emissions and lead exposure in the workplace are discussed in separate bibliographies. (Contains 160 citations fully indexed and including a title list.)

5530 Agriculture and Food Technology

Refer also to citation(s) 35919, 35920, 35921, 35922, 35923, 37213, 37347

37333 (CNIC–00139) **Study on residues and degradation of ^{14}C-phoxim in spring wheat plants and soil.** Zhu Shuxiu; Yin Lishang. China Nuclear Information Centre, Beijing, BJ (China). Jan 1988. 15p. (In Chinese). (A65-IAAE–0012). Order Number DE89613763/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A potting experiment on residues and degradation of ^{14}C-phoxim in spring wheat plants and soil was conducted in 1984~1986. Seed dressing or soil mixing and spraying with ^{14}C-phoxim had been done at sowing and seedling stage respectively. The radioactivities of samples were detected on the low background (3cpm) GM or Backman LS 7800 liquid scintillation counter. The transmission, dissociation and residues of ^{14}C-phoxim in spring wheat plants and soil were investigated. The amount of ^{14}C-phoxim residues in the grains was determined. The dissipation of the residues of ^{14}C-phoxim after the harvesting of spring wheat plants were discussed; the residues could be decomposed into $^{14}CO_2$, dissolved in evaporated liquid and throwed into air, or stored in soil.

37334 (ORNL/FTR–2942) **[Radiological incidents, Tours, France, June 18–June 24, 1988]: Foreign trip report.** Hoffman, F.O. Oak Ridge National Lab., TN (USA). 5 Jul 1988. 7p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014059/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

At the request of the US Department of Energy (DOE) the traveler participated in a bilateral US/French conference on responses to radiological incidents. The meeting was held in Tours, France on June 20 through 23, 1988 at the Centre D Etudes Du Ripault, headquarters of the Commisariat Energie Atomique (CEA). The traveler presented a paper on the use of mathematical models for estimating the levels of radioactivity in foodstuffs subsequent to an accidental release that would require either restriction of human consumption or intervention to reduce or eliminate the potential for human exposure to radioactivity. The traveler reviewed the intervention levels that became effective during the Chernobyl accident as well as levels that have been recommended by the International Atomic Energy Agency (IAEA), the World Health Organization, the Commission of the European Communities, and the International Commission on Radiological Protection. These discussions stressed the importance of the political process under emergency situations whereby recommendations made by the authoritative scientific community may be ignored in favor of increased conservatism. The values presented by the French speakers as potential intervention levels were found to be a factor of 5 to 50 higher (i.e., less restrictive) than values proposed by international organizations. At the conclusion of the discussion topic on the derivation of intervention levels, the traveler proceeded to the IAEA in Vienna, where he completed revisions on a draft of a proposed IAEA Safety Series on "Procedures for Evaluating the Reliability of Predictions Made By Environmental Transfer Models."

37335 (ORNL/FTR–3043) **[International workshop on terrestrial field testing of pesticide, Cambridge, United Kingdom, September 11–16, 1988]: Foreign trip report.** Suter, G.W. II. Oak Ridge National Lab., TN (USA). 30 Sep 1988. 6p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014063/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler attended a workshop on Terrestrial Field Testing of Pesticides and presented a paper on Risk Assessment Models. The workshop addressed the role of field testing in assessment and discussed procedures for testing. Environmental assessment problems are similar for pesticides and other chemicals, but such problems are accentuated for pesticides because of their high toxicity and the fact that these substances are applied at rates that are intended to be bioactive. The major issue of contention was the relative roles of laboratory testing, filed testing, and monitoring the effects of pesticide use.

37336 **Effects of ozone and simulated acid rain on mycorrhizal infection in two families of Pinus taeda L.** O'Neill, E.G. (Environmental Sciences Div., Oak Ridge National Lab., Oak Ridge, TN (US)); McLaughlin, S.B. *Bulletin of the Ecological Society of America (USA),* 68(3): 379-380 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

Twelve-week-old Pinus taeda seedlings from two families, mycorrhizal with Pisolithus tinctorius, were exposed to factorial combinations of simulated acid rain (pH = 3.5, 4.3, 5.0) and O_3 (charcoal-filtered air, ambient air plus 80 nL L^{-1} or 160 nL L^{-1} O_3) in open-top chambers from August to November 1986. Mycorrhizal infection was assessed before initiation of treatments and after 6 or 12 weeks of exposure by a visual estimate of the percent of short roots infected. The two families differed significantly ($P \leq 0.05$) in percent infection at all harvests; however, no interactions between family and O_3 occurred. No effects of rain pH were found. Mycorrhizal infection was significantly decreased in both O_3 treatments at the 12-week harvest. Changes in mycorrhizal infection through time are discussed relative to patterns of seedling root growth.

37337 **Long-term recovery of northern hardwood forest following gamma irradiation.** Murphy, P.G. (Michigan State Univ., East Lansing, MI (US)); Sharitz, R.R. *Bulletin of the Ecological Society of America (USA),* 68(3): 374 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

A northern Wisconsin hardwood forest was exposed to 3300 hours of point-source gamma irradiation from 3 May to 16 October, 1972. Cumulative exposure was approximately 55 kR at 10 m from the source. The abundance of tree species, by size class, was monitored over a 12 year period following irradiation. Within two years, the number of tree seedlings was reduced by more than 90% and all trees greater than 2.5 cm in diameter were eliminated, within 10 m of the radiation source. Subsequently, the establishment and growth of tree seedlings within 15 m of the source has been inhibited by the growth of heliophilic plants (up to 110 stems/m^2) of the genus Rubus. In the zone just beyond 15 m, a band of Corylus cornuta shrubs has developed. The few colonizing trees that have attained a diameter of 2.5 cm or more over the 12 year post-irradiation period are of successional species. Overall, patterns of forest recovery appear similar to those following other stresses.

37338 **Evaluating spatial patterns of forest productivity in a disturbed, mountainous landscape using LANDSAT data and a GIS.** Graham, R.L. (Oak Ridge National Lab., Oak Ridge, TN (US)); Iverson, L.R.; Cook, E.A. *Bulletin of the Ecological Society of America (USA),* 68(3): 314 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

An unsupervised classification of a LANDSAT Thematic Mapper (TM) scene of the Great Smoky Mountains National Park was done using all 7 spectral bands. The resulting TM class values for pixels ground-referenced to 128 forest productivity plots were extracted from the scene and paired with the plots' productivity values. The paired TM class/productivity values revealed significant differences in forest productivity between TM classes. On this basis the TM classes were reassigned to three productivity classes and a digitized forest productivity map of the entire TM scene generated. Using a Geographic Information System (GIS), this map was then overlaid with digitized topography and disturbance maps. Patterns of forest productivity were evaluated in reference to historic land disturbances and topography. Productivity information indices were calculated for each disturbance type.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

Refer also to citation(s) 35803, 35823, 35832, 37233, 37334, 37417, 37645, 37662

37339 (AD-A–204823/9/XAB) **Resistance of bacterial spores to ultraviolet light.** Setlow, P. Connecticut Univ. Health Center, Farmington, CT (USA). Dept. of Biochemistry. 1988. 13p. Available from NTIS, PC A03/MF A01.

Pub. in Comments on Molecular and Cellular Biophysics, Vol. 5, No. 5, 253-264(1988).

Dormant spores of gram-positive bacteria, such as the various Bacillus species, usually are more resistant to killing by ultraviolet light than are growing cells. During the first minutes of spore germination, the spore's UV resistance rises significantly before dropping to the decreased value of the vegetative cell. For all strains of all species that have been tested, the spores are considerably more UV-resistant than their corresponding growing cells. Since the killing of cells or spores by UV-radiation is due to the presence of UV-induced photoproducts in DNA, there are two major factors that might be expected to influence UV resistance. (1) the UV photochemistry of the DNA in vivo, i.e., the type of photoproducts formed in DNA by UV radiation, the quantum efficiency of their formation, and their lethality; and (2) the efficiency of the repair or removal of these photoproducts. The DNA in the dormant spores has a different UV photochemistry than does the DNA in the growing cell, while the young germinated spore's DNA may exhibit a third type of UV photochemistry. There is at least one repair system which is specific for UV photoproducts produced in the dormant spore, as well as repair systems that act on UV photoproducts formed in other stages of growth.

37340 (CONF-8704370–, pp. 29-38) **SOS mutagenesis and replisome reactivation in bacteria: options acquired by transposition?.** Witkin, E.M. (Rutgers, The State Univ. of New Jersey, Piscataway (USA)); Roegner-Maniscalco, V. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

In Escherichia coli, mutagenesis by ultraviolet light (UV) and many carcinogenic chemicals requires the RecA and UmuDC proteins, which are induced by DNA damage as components of the survival-enhancing SOS response. The authors show that RecA and UmuDC can interact, at least functionally, not only in UV mutagenesis but also in induced replisome reactivation (IRR), a newly recognized SOS function required for recovery from inhibition of DNA synthesis caused by UV damage. The authors propose that error-prone translesion DNA replication is possible at every site of blocked replication, although it actually occurs only at sites that are refractory to accurate modes of repair or tolerance of UV damage. They discuss evidence that umuDC and at least one of its plasmid-borne analogs, mucAB on plasmid pKM101, are (or once were) carried on transposons, and that SOS mutability (and possibly enhanced replisome reactivation activity) may be gained or lost by transposition.

37341 (CONF-8704370–, pp. 195-208) **Mutation induction by MR(P) and its modification by various conditions.** Sobels, F.H. (Univ. of Leiden (Netherlands)); Eeken, J.C.J. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

Findings obtained in their laboratory over the last eight years on the induction of mutations by transposition of P elements under the influence of male or meiotic recombination (MR) are reviewed: (1) Localization of 144 MR-h12-induced lethals showed differences with the distribution of X-ray-induced lethals and with those arising spontaneously in the absence of MR. In situ hybridization provided evidence that MR-induced mutation is associated with transposition of P elements. (2) The effect of mutagens was studied by employing reversion of an MR-induced singed (sn) mutation by excision of the P element. This process was not noticeably affected by exposure to high mutagenic concentrations of ethylnitrosourea (ENU), methylmethanesulfonate (MMS), formaldehyde, and X-irradiation. (3) Under conditions of defective DNA repair as with mei-9 and mei-41, the frequency of forward mutations to sn and raspberry (ras) is enhanced, but reversion of sn is decreased. (4) A synergistic effect between MR and X rays was observed for the induction of recessive lethals. (5) From experiments in which the segregation of MR could be followed after having produced a mutation, it could be concluded that, after this event, MR retains its capacity to produce reverse mutations. (6) A molecular analysis of geographically different MR strains characterized by different potency to produce reverse mutations shows correlation of this property and the number of P elements present. (7) Following both heat and cold treatments, some enhancement of the frequency of reversion of different insertion element mutations was observed.

37342 (CONF-8704370–, pp. 319-336) **Mobile genetic elements, spontaneous mutations, and the assessment of genetic radiation hazards in man.** Sankaranarayanan, K. (State Univ. of Leiden (Netherlands)). Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

Studies during the past 20 years have amply documented the existence of mobile genetic elements (MGEs) and the significant role they play in the genesis of spontaneous mutations in a number of eukaryotes. Furthermore, some of the dispersed repetitive DNA sequences present in mammalian (including human) genomes are thought to represent putative MGEs on the basis of their molecular structural similarities to the authentic MGEs in other organisms. However, at present, data that bear on spontaneous mutational effects of insertion of MGEs and on the question of whether MGEs can be induced to become mobile by radiation exposures are very limited in these species. The aims of this paper are (1) to briefly review some of the important properties of eukaryotic MGEs, including genetic effects caused by these and the effects of mutagens; (2) to examine the possible consequences of mobility of MGEs in the human genome and the probable reasons for our inability to detect MGE-mediated spontaneous mutations in man; (3) to consider the relevance of this analysis in the context of the estimation of genetic risks to man associated with exposures to ionizing radiation; and finally, (4) to present some views on where to seek evidence for MGE-mediated mutational effects in man.

37343 (CONF-8905157–1) **Risk assessment and late effects of radiation in low-earth orbits.** Fry, R.J.M. Oak Ridge National Lab., TN (USA). 1989. 15p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From Symposium on radiation hazards in space and biological consequences; Washington, DC, USA; 11 May 1989. Order Number DE89013043/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The radiation dose rates in low-earth orbits are dependent on the altitude and orbital inclination. The doses to which the crews of space vehicles are exposed is governed by the duration of the mission and the shielding, and in low-earth orbit missions protons are the dominant particles encountered. The risk of concern with the low dose rates and the relatively low total doses of radiation that will be incurred on the space station is excess cancer. The National Council on Radiation Protection and Measurements has recently recommended career dose-equivalent limits that take into account sex and age. The new recommendations for career limits range from 1.0 Sv to 4 Sv, depending on sex and on the age at the time of their first space mission, compared to a single career limit of 4.0 Sv previously used by NASA. Risk estimates for radiated-induced cancer are evolving and changes in the current guidance may be required in the next few years. 10 refs., 1 fig., 3 tabs.

37344 (CONF-8906137–1) **Chemical and nuclear emergencies: Interchanging lessons learned from planning and accident experience.** Adler, V.; Sorensen, J.H.; Rogers, G.O. Oak Ridge National Lab., TN (USA). 1989. 14p. DOE Contract AC05-84OR21400. From Joint NEA/CEC workshop on technical aspects of emergency planning; Brussels, Belgium; 27-29 Jun 1989. Order Number DE89013006/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Because the goal of emergency preparedness for both chemical and nuclear hazards is to reduce human exposure to hazardous materials, this paper examines the interchange of lessons learned from emergency planning and accident experience in both industries. While the concerns are slightly different, sufficient similarity is found for each to draw implications from the others experience. Principally the chemical industry can learn from the dominant planning experience associated with nuclear power plants, while the nuclear industry can chiefly learn from the chemical industry's accident experience. 23 refs.

37345 (CONF-8906140–1) **An update on standards for radiation in the environment and associated estimates of risk.** Kocher, D.C. Oak Ridge National Lab., TN (USA). 21 Jun 1989. 54p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From Health Physics Society summer school; Santa Fe, NM, USA; 19-23 Jun 1989. Order Number DE89013704/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This presentation reviews current and proposed standards, recommendations, and guidances for limiting routine radiation exposures of the public, and estimates the risk corresponding to standards, recommendations, and guidances. These estimates provide a common basis for comparing different criteria for limiting public exposures to radiation, as well as hazardous chemicals.

37346 (INIS-mf–11440, pp. 580-581) **Evaluation of human internal irradiation owed to Cs-134 and Cs-137 from food after 26.04.1986.** Chiosila, I. (Spitalul Fundeni, Bucharest (Romania)); Chirovici, M.; Reviu, E. Central Inst. of Physics, Bucharest (Romania). 1988. (In Romanian). (CONF-8810372–: Advances in physics, Constanta, Romania, 6-8 Oct 1988). In *Advances in Physics.* Order Number DE89012158/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Irradiation doses received by man following ingestion of food contaminated with Cs-134 and Cs-137 are presented. (authors).

37347 (INIS-mf–11448) **Conference handbook.** Australian Inst. of Nuclear Science and Engineering, Lucas Heights (Australia). 1987. 54p. (CONF-8708339–: 11. AINSE radiation biology conference, Lucas Heights, Australia, 24-25 Aug 1987). Order Number DE89616297/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Topics covered by the conference include food irradiation, mutagenesis, mammalian radiation biology, biological and physical dosimetry and radiation responses in nuclear medicine.

37348 (INIS-mf–11448, pp. 42) **Samarium 153 chelate localization in malignant melanoma.** Webb, J. (Freemantle Hospital (Australia)); Witt, B.C. de; Sorby, P.; Boyd, R.E.; Martindale, A.A. Australian Inst. of Nuclear Science and Engineering, Lucas Heights (Australia). 1987. (CONF-8708339–: 11. AINSE radiation biology conference, Lucas Heights, Australia, 24-25 Aug 1987). In *Conference handbook.* Order Number DE89616297/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

SAMARIUM 153/melanomas; BIOLOGICAL LOCALIZATION; CHELATES; MELANOMAS; UPTAKE

37349 (INIS-mf–11448, pp. 22) **Ionising radiation and its application to biotechnology.** Williams, J.H. (La Trobe Univ., Bundoora (Australia). Dept. of Microbiology); MacPhee, D.G. Australian Inst. of Nuclear Science and Engineering, Lucas Heights (Australia). 1987. (CONF-8708339–: 11. AINSE radiation biology conference, Lucas Heights, Australia, 24-25 Aug 1987). In *Conference handbook.* Order Number DE89616297/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

RECOMBINANT DNA/biological radiation effects; CHROMOSOMES; IONIZING RADIATIONS; MUTANTS; PLASMIDS

37350 (INIS-mf–11448, pp. 40) **In vitro radiosensitivity of human malignant melanoma cells to low and high LET radiation.** Brown, J.K. (Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia)); Mountford, M.M.; Allen, B.J.; Mishima, Y.; Ichihashi, M.; Parsons, P. Australian Inst. of Nuclear Science and Engineering, Lucas Heights (Australia). 1987. (CONF-8708339–: 11. AINSE radiation biology conference, Lucas Heights, Australia, 24-25 Aug 1987). In *Conference handbook.* Order Number DE89616297/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

ANIMAL CELLS/radiosensitivity; RADIOSENSITIVITY; BIOLOGICAL RADIATION EFFECTS; LET; MELANOMAS; RADIATION DOSES

37351 (INIS-mf–11448, pp. 38) **Micronuclei: an important end-point in radiation biology.** Fenech, M. (Flinders Univ. of South Australia, Bedford Park (Australia)). Australian Inst. of Nuclear Science and Engineering, Lucas Heights (Australia). 1987. (CONF-8708339–: 11. AINSE radiation biology conference, Lucas Heights, Australia, 24-25 Aug 1987). In *Conference handbook.* Order Number DE89616297/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

CELL DIVISION/chromosomes; BIOLOGICAL RADIATION EFFECTS; CHROMOSOMES; CHROMOSOMAL ABERRATIONS

37352 (INIS-mf–11448, pp. 37) **Radiation sensitivity of human natural killer cells recognising bone marrow targets.** Flannery, G. (La Trobe Univ., Bundoora (Australia). Dept. of Genetics); Oliver, E. Australian Inst. of Nuclear Science and Engineering, Lucas Heights (Australia). 1987. (CONF-8708339–: 11. AINSE radiation biology conference, Lucas Heights, Australia, 24-25 Aug 1987). In *Conference handbook.* Order Number DE89616297/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

ANIMAL CELLS/radiosensitivity; RADIOSENSITIVITY; BONE MARROW; IRRADIATION; RADIATION DOSES

37353 (INIS-mf–11448, pp. 34) **Cellular stress induced by UV-radiation and hyperthermia - a common mechanism.** Watson, K. (New England Univ., Armidale (Australia). Dept. of Biochemistry and Nutrition). Australian Inst. of Nuclear Science and Engineering, Lucas Heights (Australia). 1987. (CONF-8708339–: 11. AINSE radiation biology conference, Lucas Heights, Australia, 24-25 Aug 1987). In *Conference handbook.* Order Number DE89616297/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

YEASTS/biological radiation effects; BIOLOGICAL STRESS; DNA; HYPERTHERMIA; ULTRAVIOLET RADIATION; YEASTS

37354 (INIS-mf–11448, pp. 20) **Radiation and feeding effects on O_2 uptake in frog tadpoles.** Panter, H.C. (Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia)); Chapman, J.E.; Williams, A.R. Australian Inst. of Nuclear Science and Engineering, Lucas Heights (Australia). 1987. (CONF-8708339–: 11. AINSE radiation biology conference, Lucas Heights, Australia, 24-25 Aug 1987). In *Conference handbook.* Order Number

DE89616297/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

FROGS/biological radiation effects; FASTING; FROGS; IRRADIATION; LARVAE; OXYGEN; RADIATION DOSES; UPTAKE

37355 (INIS-mf-11984) **Radiation injuries of the intestine, treated in the Surgical Department of Wuerzburg University Hospital between 1974 and 1982.** Ho, H.V. Wuerzburg Univ. (Germany, F.R.). Medizinische Fakultaet. 14 Feb 1985. 49p. (In German). Order Number DE89788317/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The study was based on record sheets of patients operated for radiation injuries of the small and/or large intestine at any time during the period between 1974 and 1982. The available hospital data on radiation injuries and their treatment were reviewed and, the pertinent pathological substrate being well-known, analysed with the aim to evaluate the various surgical options.

37356 (INIS-SU–82, pp. 47-50) **On thorium and plutonium cocrystallization with calcium oxalate.** Basalaeva, L.N.; Bekyasheva, T.A.; Popov, D.K. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Study of possibility of ^{239}Pu and ^{234}Th concentration from bone ashe (calcium phosphate) hydrochloric acid solutions by coprecipitation with nonisotopic medium (CaC_2O_4) for their further radiometry or alpha-spectrometry is carried out. Thorium and plutonium distribution coefficients in calcium oxalate precipitate - solution system, as well as coefficients of Th and Pu cocrystallization with CaC_2O_4 and cocrystallization type are determined. Possibility of Pu and Th concentration from bone tissue solutions is demonstrated on small oxalate amount containing 25% of Ca total amount in bone tissue. 3 refs.; 2 tabs.

37357 (INIS-SU–82, pp. 59-63) **Interconnection of individual peculiarities of blood system with radiation syndrome severity in animals.** Kulikova, S.B.; Voevodina, T.M. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

To establish interconnection between initial blood indices and radiation syndrome severity experiments on rats of the same sex, age and breeding conditions were carried out. The obtained data permitted to suppose that even in one sex some organism features, reflecting in initial peripheric blood indices, have an effect on acute radiation syndrome process. 10 refs.; 3 tabs.

37358 (INIS-SU–82, pp. 67-69) **Dependence of reproduction indices of female mice on their age under the effect of fractionated irradiation.** Bazyukina, M.A. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Radiosensitivity of reproduction of different age female mice subjected to fractionated irradiation before or after conception is compared. It is stated that low dose fractionated irradiation in older age female mice suppresses reproductive function: a tendency to fertility decrease, disturbance of genetic activity in part of animals, progeny decrease are detected. In young female mice similar irradiation doesn't cause the above-mentioned consequences. 4 refs.; 1 tab.

37359 (INIS-SU–82, pp. 69-73) **Experimental model of radiation injuries of liver.** Merkushev, G.N. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

In experiments on rats it is shown that hepatectomy causes changes in all systems of intracellular supply, first of all in membranocomplexes relating to protein energy metabolism and synthesis. Phase response of these changes is in accordance with development of destructive and proliferative periods of reparation process. Irradiation results in break of rhythm of phase structural changes and metabolism of regenerating liver. Analysis of the data given permits to conclude that for regenerating liver radioprotection is more necessary than for intact one, but to study radioprotective means they can be tested on both intact and regenerating liver. 7 refs.; 1 tab.

37360 (INIS-SU–82, pp. 74-79) **Formation and prevention of destructive changes in mucous membranes of stomach of irradiated rats.** Ponomareva, T.V.; Artamonova, E.A. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

In experiments on rats prophylactic effect of medicinal preparations with different mechanism of action, e. g. tranquilizers, antihistaminic means and radioprotectors is studied and compared. It is stated that some medicinal preparations usually used in treating stomach peptic ulcer may also have prophylactic effect preventing development of stomach destructive changes caused by stress. Cymetidine is the most effective for this purpose. Gammaphos didn't have radioprotective effect on stomach. 13 refs.; 2 tabs.

37361 (INIS-SU–82, pp. 86-91) **Comparative radiosensitivity of oocytes of various stages of maturity.** Strel'nikova, N.K.; Vislenko, O.V. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Radiosensitivity of oocytes of various stages of maturity during local low dose irradiation of mice gonads was studied. It is shown that in case of whole-body and local high dose and low dose irradiation the most radiosensitive are oocytes in follicles of those stages of maturity that correspond to maximum cyclic neurohormonal changes in female organism. It permits to suppose that changes of neuroendocrinal regulation of reproduction process form the basis for increased radiosensitivity of reproduction in irradiated female mice. 6 refs.; 2 tabs.

37362 (INIS-SU–82, pp. 29-32) **Substantiation of rate setting of surface contamination with amino acids, labelled with tritium.** Zhesko, T.V. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

For rate setting of surface contamination with the wide-spread biogenic tritium compounds-protein predecessors-experimental study of skin absorption and skin deposit of amino acids labelled with tritium is carried out on rats. While extrapolating data to people and calculating tolerable skin contamination with ^{3}H- amino acids, it is supposed that people arm skin, 100-500 cm^2, has no defects and that the skin surface decontamination after radionuclide contact is carried out with a preparation, efficiency of which is not less than 97%. The value of tolerable skin absorption of tritium amino acids, being 110-550 MBq/year or 4.8 kBq/cm^2 per one working day, is calculated. 8 refs.; 1 tab.

37363 (INIS-SU–82, pp. 38-41) **On the effect of iron on plutonium metabolic mechanism in liver tissue.** Shvydko, N.S.; Rushonik, S.I. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

To determine plutonium metabolic mechanism in blood-lever system and in the liver tissue, the effect of iron on these processes, kinetics of radionuclide distribution in the liver and its fractions in animals that intook only plutonium (control group) and plutonium and per os iron (test group) was compared. It is stated that under iron effect increased plutonium content is deposited in the liver during all examination period. Therewith, maximum plutonium content is observed in the period from 6 to 24 hours (37 and 30% in comparison with 14 and 19% in control group). Later on decrease of plutonium content is observed, but in liver of rats incorporating iron plutonium

content is 1.5 times higher than in control group. Ferritine effect on plutonium metabolic mechanism in liver is discussed. 7 refs.; 1 tab.

37364 (INIS-SU–82, pp. 41-44) **^{210}Po incorporation to the structure of sulfurcontaining aminoacids.** Ponikarova, T.M. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Possibilities of ^{210}Po incorporation to methionine structure are ascertained on plants and white laboratory rats. Analysis of results obtained in experiments with ^{35}S shows that methionine synthesis during plant growth begins already in root system. Pecrystallization results testify to the fact that ^{210}Po, being sulfur analogue, substitutes it in synthesis for plants of sulfur containing aminoacids, forming methionine- and cystine-like compounds. When analysing possbility of ^{210}Po incorporation to methionine structure in animal body it is stated that ^{210}Po incorporates to molecule structure during aminoacid synthesis. It is supposed that in animals and man organism ^{210}Po forms, primarily, protein complexes. 5 refs.; 1 tab.

37365 (INIS-SU–82, pp. 44-47) **Effect of change in diet on excretion of plutonium-239 from organism.** Ivanova, N.P. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

To check supposition on milk effect on plutonium-239 excretion from organism the portable water for rats, contained in individual metabolic cages permitting separate excretion analysis, was replaced by milk. Some days later milk was excluded from diet. 24-hourly rate of radionuclide with feces and urine excretion from organism was determined. On the basis of preliminary data analysis it is supposed that interaction of some milk components with biocomponents of blood and deposition organ tissues violate ^{239}Pu steady equilibrium distribution in organism, affecting its metabolism through the intermediary of blood system. It results in increased plutonium excretion. 2 refs.; 1 tab.

37366 (INIS-SU–82, pp. 63-67) **Some questions of blastomogenic effect of internal irradiation on mammary gland.** Rusanova, O.V. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

On the basis of numerous data incorporated radionuclide effect on mammary gland is generalized. Importance of dose, dose rate, fractionation, effect of low dose beta irradiation from ^{3}H, ^{14}C and ^{35}S sources, their comparative carcinogenesis are discussed. The age modifying effect on neoplasms, as well as effect of morphofunctional mammary gland changes relating to different biological stages of organism and in lactation period are taken account of. 18 refs.

37367 (INIS-SU–82, pp. 80-83) **Biological effects of ^{137}Cs, incorporated into organism of rats.** Monakhov, A.S.; Strekalov, S.A.; Sokolov, A.V.; Aver'yanova, T.K. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Results of investigating mutagenous and hemotoxic effects of ^{137}Cs on blood lymphocytes of rats are presented. ^{137}Cs was orally administrated into organism of rats as 270 kBq/g chloride solution. ^{137}Cs mutagenous effect was studied on metaphase plates of rat blood lymphocytes in course of rats lifetime experiment. It is stated that ^{137}Cs inducing severe disturbances of genetic material in a great quantity of blood lymphocytes, causes their total killing. 5 refs.; 2 tabs.

37368 (INIS-SU–82, pp. 83-86) **Radiobiological effects of fractionated intake of ^{3}H-nucleosides by mammalian organism.** Chetchueva, M.Eh. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Results of experimental study of fractionated intake of ^{3}H-TgP and ^{3}H-TsdP by mice organism are presented. As biological tests changes of testic mass and frequency of dominant lethal mutations (DLM) were chosen. Authetic difference in changes of testis mass indices was observed after a single, three-time and ten-time administration of ^{3}H-DgP to animal organism. During 10-time ^{3}H-TsdP incorporation 2.2 times as many cells died than in single intake of equal tritium activity. Similar result is obtained in experiment carried out according DLM technique. Necessity of accounting results of fractionated intake of tritium by mice organism in extrapolation to people is pointed out. 3 refs.; 2 tabs.

37369 (INIS-SU–82, pp. 91-94) **Dependence of animal life span shortening on dose rates in case of internal irradiation.** Borisova, V.V. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Shortening of animal life span depending on a single and daily intake of ^{137}Cs and ^{90}Sr is studied. It is shown that both with chronic and single intake of the given radionuclides the effect/dose dependence by the animal death criterion is of S-type character. At the same time, the definite peculiarities in the animal death kinetics depending on the amount of nuclide intake and, consequently, on the dose rate, are pointed out. These peculiarities are defined by both differences in the fife span and animal death causes. When introducing comparatively small amounts of ^{90}Sr the animal life span was longer and they died of nonspecific diseases relating to loss of general resistence of organism. In death pathogenesis of animal, that had higher doses of ^{90}Sr, specific radiation injuries, caused by direct radiation effect, made a significant contribution. 3 refs.; 2 tabs.

37370 (INIS-SU–82, pp. 50-59) **New aspects in studying the effect of low dose ionizing radiations.** Troitskaya, M.N. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

On the basis of literary data biological effect of low dose irradiation on organism is analysed. Effect of natural background on development of living organisms, stimulating and carcinogenic effect of low dose irradiation are discussed. Discussion data on possible threshold radiation effect, as well as investigations in determining death hazard because of neoplasms in a-bomb survivors of Hirosima and Nagasaki are presented. Possibility of developing dose-effect relationships mathematical models is discussed. 31 refs.

37371 (INIS-SU–82, pp. 145-148) **Morphological content of rat peripheral blood in combined effect of radiation factors.** Yakovleva, N.G. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Combined effect of two radiation factors: a single x-irradiation and internal irradiation due to chronic intake of ^{90}Sr and ^{144}Ce radionuclides, on blood morphology is studied. In combined effect of radiation factors on morphological blood content 3 periods are distinguished. In the first period the blood changes correspond to an acute radiation injury without severe consequences. The second normalization period was muck shorter than in case of external irradiation alone. In the third period external preirradiation was complicated by aftereffects of long-term ^{90}Sr and ^{144}Ce radionuclide intake. The experiment have shown that combined radiation delayed effects result in deep shifts in morphology of rat peripheral blood. 4 refs.; 2 tabs.

37372 (INIS-SU–82, pp. 103-106) **Combined effect of incorporated ^{90}Sr, alcohol, and tobacco smokes on reproduction of warm-blooded animals.** Mashneva, N.I. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Combined effect of incorporated ^{90}Sr, ethanol, tobacco smokes on reproduction of warm-blooded animals is studied. It is shown that chronic intake of strontium 90, ethanol and tobacco smokes suppresses the reproduction of animals. But difficulty of obtained data extrapolation to a human being is not a sufficient ground for revising existing hygienic standards for persons being in contact with ionizing radiation and habitual to alcohol and smoking. Nevertheless, they permit to set a problem on negative effect of such habits. 7 refs.; 1 tab.

37373 (INIS-SU–82, pp. 110-114) **Effect of Sr^{90} and ethanol on work ability in case of combined and separate action of these factors.** Pul'kov, V.N. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Effect of ^{90}Sr and ethanol on workability of white mice males in long-term experiment is studied. It is shown that dynamic workability is decreased to a greater extent at ^{90}Sr effect than at ethanol one. The data on predominance of the effects of combined action of these factors are obtained. Differences in time regularities of dose-effect dependence for the studied factors make it difficult to get a unique answer to the question about the character of combined action. By most factors a slight increase of combined radionuclide and ethanol effect in the end of experiment, as well as accelerated decrease of muscular work, are detected. Lower radionuclide doses hat no effect on the value of combined action that is totally referred to ethanol action. 3 refs.; 3 tabs.

37374 (INIS-SU–82, pp. 106-110) **Combined effect of internal irradiation, alcohol and smoking on some immunological indices.** Shubik, V.M. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

It is shown that chronic intake of 0.21 kBq/g ^{210}Po per day by laboratory animals after three months of experiment results in increase of autoantibody concentration to hepatic tissue and circulating immune complexes (CIC). Combined effect of radionuclide with ethanol or tobacco smokes didn't result in increase of autoantibody and CIC concentration independent of ^{210}Po concentration in experiments. During combined single chronic effect of radionuclide, ethanol and tobacco smokes considerable increase of autoantibody titers, particularly to hepatic tissue, as compared to mice, which intake of these components was separate, was detected. The results rermit to suppose on additive action of ^{210}Po, alcohol and tobacco smokes in case of their chronic effect on the boDy of laboratory animals. 4 refs.; 1 tab.

37375 (INIS-SU–82, pp. 157-161) **Modeling of combined effect of alcohol, tobacco smokes and internal irradiation of laboratory animals.** Sukal'skaya, S.Ya. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Concentration of ^{90}Sr and ^{20}Po in kidneys and bone tissues was measured both separately and in combination with ethanol introduction. Carbon oxide (CO), which content was measured by a gas analyser, served as an index of tobacco smokes in a chamber with test animals. It is shown that ethanol had no noticeable effect either on the character or the levels of radionuclide accumulation in kidneys and bone tissues. Under experimental conditions quantitative characteristics of studied factors (intensity, the effect time and levels) remained stable within the specified limits independent on their combination. 6 refs.

37376 (ISH–123) **Biological indicators for giving proof of exposure to ionizing radiation - lectin coupling to human blood cells possibly a 'biological dosemeter'?.** Schreiber, G.A.; Spiegelberg, A.; Boegl, K.W.; Willich, N. Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene. Jun 1988. 134p. (In German). Available from Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene.

The present study has been conducted in an attempt to quantify radiation-induced changes in oligosaccharides of the cell membrane of human blood cells. The purpose of this study was to estimate the dose to the body based on the measured changes in lectin binding capacities. The lectin coupling system has been described as a dosimetric system. Statistically the different blood cell types showed different degrees of radiation sensitivity which was demonstrated by increased lectin binding. The method was intended to be optimized so as to enable dose assessments for individuals as well. In addition to the described method which is based on the use of tritium-labelled concanavalin A, two other radiological methods - i.e. BSA-separation and cell-harvester-separation - were tested for their suitability. However, the radiological methods enabled neither the above mentioned differences in radiosensitivity to be confirmed nor a sufficient amount of reproducible results in blood samples of healthy donors after in vitro irradiation to be obtained. Using fluorescence-labelled concanavalin A and wheat germ agglutinin, flow cytometric measurements of fluorescence intensity yielded the reproducible result of enhanced lectin binding to platelets, lymphocytes and monocytes in the dose range of 0,5 to 5 Gy after in vitro irradiation. Differences in radiosensitivity could not be detected with this method. Therefore on the model 'radiation therapy patient' the suitability of lectin coupling as a 'biological dosemeter' could not be demonstrated.

37377 (KIYI–88-23) **Intensity of DNA synthesis in immunocompetent organs of animals in early periods after neutron irradiation with different energy values.** AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 28p. (In Russian). Order Number DE89012162/JAW. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Individual papers in scope for the data base are processed separately.

37378 (KIYI–88-23, pp. 3-13) **DNA exchange in mice spleen at early periods following fast neutron irradiation with different energy rate.** Indyk, V.M.; Antonenko, G.I.; Parnovskaya, N.V. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). In *Intensity of DNA synthesis in immunocompetent organs of animals in early periods after neutron irradiation with different energy values.* Order Number DE89012162/JAW. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

The DNA-synthesis in spleen of animals at early periods following fast neutron irradiation with average energy of 22 MeV produced in the reaction d/50 MeV/-> Be as compared to fission spectrum neutrons (E~1.2 MeV) is investigated. ^{60}Co γ-quanta are used as standard radiation. It is shown that the rate of mass recovery of organs, their cellular nature, DNA content and indices of its specific activity have dose and time dependences, as well as they considerably differ at different neutron energy values and different quality radiation. With the increase of neutron energy their biological activity decreases. 9 refs.; 3 figs.; 2 tabs.

37379 (KIYI–88-23, pp. 14-26) **DNA biosynthesis content and intensiveness in mice thymus at early periods following fast neutron irradiation with different energy rate.** Indyk, V.M.; Antonenko, G.I.; Parnovskaya, N.V. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). In *Intensity of DNA synthesis in immuno-competent organs of animals in early periods after neutron irradiation with different energy values.* Order Number DE89012162/JAW. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Biosynthesis of dna of the thymic glands of animals irradiated by fast neutrons with different energy values in the early post-irradiation period is investigated. It is shown that the rate of mass recovery in organs, their cellular nature, dna content and indices of their specific activity have the dose and time dependences, as well as they considerably differ at different neutron energies and different quality radiation. With the increase of neutron energy value their biological effectiveness decreases. 18 refs.; 3 figs.; 2 tabs.

37380 (NUREG/CR–4214-Rev.1-Pt.2) **Health effects models for nuclear power plant accident consequence analysis: Low LET radiation: Part 2, Scientific bases for health effects models.** Abrahamson, S.; Bender, M.; Book, S.; Buncher, C.; Denniston,

C.; Gilbert, E.; Hahn, F.; Hertzberg, V.; Maxon, H.; Scott, B. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications; Sandia National Labs., Albuquerque, NM (USA). May 1989. 316p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (SAND–85-7185-Rev.1-Pt.2). Available from NTIS, PC A14/MF A01 - GPO - OSTI.

This report provides dose-response models intended to be used in estimating the radiological health effects of nuclear power plant accidents. Models of early and continuing effects, cancers and thyroid nodules, and genetic effects are provided. Two-parameter Weibull hazard functions are recommended for estimating the risks of early and continuing health effects. Three potentially lethal early effects – the hematopoietic, pulmonary and gastrointestinal syndromes – are considered. Linear and linear-quadratic models are recommended for estimating cancer risks. Parameters are given for analyzing the risks of seven types of cancer in adults – leukemia, bone, lung, breast, gastrointestinal, thyroid and "other". The category, "other" cancers, is intended to reflect the combined risks of multiple myeloma, lymphoma, and cancers of the bladder, kidney, brain, ovary, uterus and cervix. Models of childhood cancers due to in utero exposure are also provided. For most cancers, both incidence and mortality are addressed. Linear and linear-quadratic models are also recommended for assessing genetic risks. Five classes of genetic disease – dominant, x-linked, aneuploidy, unbalanced translocation and multifactorial diseases –are considered. In addition, the impact of radiation-induced genetic damage on the incidence of peri-implantation embryo losses is discussed. The uncertainty in modeling radiological health risks is addressed by providing central, upper, and lower estimates of all model parameters. Data are provided which should enable analysts to consider the timing and severity of each type of health risk. 22 refs., 14 figs., 51 tabs.

37381 (ORNL/TM–10569) **Radiation exposure inside reinforced concrete buildings at Nagasaki.** Rhoades, W.A.; Childs, R.L.; Ingersoll, D.T. Oak Ridge National Lab., TN (USA). May 1989. 177p. Sponsored by Department of Defense. DOE Contract AC05-84OR21400. Order Number DE89013765/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The biological effects on the residents of Hiroshima and Nagasaki due to initial-irradiation exposure during the nuclear attacks of World War II was recognized immediately as an important source of information. After the war, an extensive effort gathered data concerning the locations of individuals at the time of the attack and their subsequent medical histories. The data from personnel located in reinforced concrete buildings are particularly significant, since large groups of occupants received radiation injury without complications due to blast and thermal effects. In order to correlate the radiation dose with physiological effects, the dose to each individual must be calculated. Enough information about the construction of the buildings was available after the war to allow a radiation transport model to be constructed, but the accurate calculation of penetration into such large, thick-walled three dimensional structures was beyond the scope of computing technology until recently. Now, the availability of Cray vector computers and the development of a specially-constructed discrete ordinates transport code, TORT, have combined to allow the successful completion of such a study. This document describes the radiation transport calculations and tabulates the resulting doses by source component and individual case location. An extensive uncertainty analysis is also included. These data are to be used in another study as input to a formal statistical analysis, resulting in a new value for the LD50 dose, i.e., the dose at which the mortality risk is 50%. 55 refs., 67 figs., 70 tabs.

37382 (PNL–6450-20-HEDR) **Hanford Environmental Dose Reconstruction Project: Monthly report.** Dennis, B.S. Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 48p. Sponsored by DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE89014546/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The project is divided into the technical tasks that address each of the primary steps in the path from radioactive releases to dose estimates. These include source terms; environmental transport; environmental monitoring data; demographics, agriculture, and food habits; and environmental pathways and dose estimates. The source terms task will develop estimates of radioactive emissions from Hanford facilities since 1944. These estimates will be based on historical measurements and production information. The environmental transport task will reconstruct the movement of radioactive materials from the areas of release to populations. Movement via the atmosphere, surface water (Columbia River), and ground water will be studied.

37383 (PNL–6822) **Life-span effects of ionizing radiation in the beagle dog: A summary account of four decades of research funded by the US Department of Energy and its predecessor agencies.** Thompson, R.C. Pacific Northwest Lab., Richland, WA (USA). Jan 1989. 327p. Sponsored by DOE Energy Research. DOE Contract AC06-76RL01830. Order Number DE89014202/JAW. Available from NTIS, PC A15/MF A01 - OSTI; GPO Dep.

Nearly 40 years ago, the US Atomic Energy Commission made a far- reaching commitment to the support of life-span radiation-effects studies in a relatively long-lived animal, the beagle dog. Something in the range of 200 million dollars has already been spent on a group of closely related experiments, many of which are only now coming to fruition. Responsible fiscal management of these studies, directed toward securing an optimum return from past investments, and toward creative planning of future directions, requires a comprehensive view of this total effort. This report is designed to provide that comprehensive view. This is primarily intended as a research management document. Evaluation and interpretation are tasks for those directly involved in conducting these experiments. The limited objective of the present document is to describe what has been done, to give some of the background for why it was done, to describe results already realized and applications that have been made of these results – all in a manner designed to display the total effort rather than piecemeal details. While proposing no specific answers to the questions "Where do we go from here?"it is hoped that the document will provide a basis for approaching that question in an informed manner. The maintenance of a continuity of scientific understanding and direction in these experiments, which often continue beyond the initiating investigators' working life, is no small part of the problem involved in conducting these experiments.

37384 (SAAS–368) **Radiation exposure to skin following radioactive contamination.** Baumann, H.; Beyermann, M.; Kraus, W. Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic). 1989. 28p. (In German). Order Number DE89616656/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In the case of skin contamination intensive decontamination measures should not be carried out until the potential radiation exposure to the basal cell layer of the epidermis was assessed. Dose equivalent rates from alpha-, beta- or photon-emitting contaminants were calculated with reference to the surface activity for different skin regions as a function of radiation energy on the condition that the skin was healthy and uninjured and the penetration of contaminants through the epidermis negligible. The results have been presented in the form of figures and tables. In the assessment of potential skin doses, both radioactive decay and practical experience as to the decrease in the level of surface contamination by natural desquamation of the stratum corneum were taken into account. 9 figs., 5 tabs., 46 refs.

37385 **Priorities for the next decade of research in radiation ecology.** Hoffman, F.O. Jr. (Oak Ridge National Lab., Oak Ridge, TN (US)); McCormick, J.F. *Bulletin of the Ecological Society of America (USA),* 68(3): 324-325 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

Radiation ecology is the study of the fate and effects of ionizing radiations in the environment. The 1986 Chernobyl accident provides unprecedented opportunities to test models of the transport of a great variety of radionuclides in a variety of ecosystems under a variety of conditions throughout the world. International collaboration provides exciting opportunities to explore the fate of radionuclides on a global scale. Our understanding of ecological effects of ionizing radiations is based almost entirely upon results of point source gamma studies such as those described in this symposium. While results of these studies are incomplete and insufficient, even less is

known of ecological effects resulting from high levels of radioactive fallout. High priority should be given to completing long term studies of previously irradiated ecosystems and to initiating studies of the ecological effects of radioactive fallout. The most challenging task is to improve and couple our knowledge of radionuclide transport, radiation dosimetry and ecological effects so that, for a given level of radioactivity released into specific ecosystems, we can predict immediate and long term consequences.

5602 Thermal Effects

Refer also to citation(s) 37295

5603 Chemicals Metabolism and Toxicology

Refer also to citation(s) 35541, 35896, 36232, 37218, 37335, 37340, 37341, 37344

37386 (CONF-8704370–, pp. 245-254) **Effects of DNA damage on transcription and transposition of Ty retrotransposons of yeast.** McEntee, K. (Univ. of California, Los Angeles (USA)); Bradshaw, V.A. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

Treatment of Saccharomyces cerevisiae with the mutagen/carcinogen 4-nitro-quinoline-1-oxide (NQO) results in increased levels of transcripts homologous to a set of DNA damage responsive (Ddr) genes. The structural characterization of one such Ddr sequence (Ddr78A) demonstrates that it is related to the retrotransposon Ty. After NQO exposure for 4-6 hours, transcripts homologous to Ddr78A, as well as to a Ty1 probe, accumulate in cells. The authors have asked whether the increased transcript levels of these transposable elements is accompanied by increased transposition. They have isolated a series of mutants that constitutively express normally glucose-repressible alcohol dehydrogenase activities, ADH2 or ADH4. Previous studies have demonstrated that most of the spontaneous constitutive mutations in these genes are due to Ty transposition. By Southern hybridization analysis of the ADH2 and ADH4 regions from more than 100 NQO-induced mutations, they present evidence that DNA damage stimulates Ty transposition to these loci by 2-13-fold.

37387 (CONF-8704370–, pp. 255-264) **Inducible cellular responses to DNA damage.** Lambert, M.E.; Garrels, J.I. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

Despite considerable efforts over the years to study specific cellular responses to DNA damage in mammalian cells, including increased expression of endogenous retroviruses, induction of DNA repair, growth arrest, and cell killing and mutagenesis, there are little systematic data on the overall patterns of change in cellular gene expression induced after exposure to DNA-damaging agents. In addition, very little is known about the functional significance of induced changes in gene expression or of the regulation of these inducible phenomena. To identify specific protein markers for inducible responses to DNA damage in mammalian cells, the authors have, therefore, utilized the QUEST system of high-resolution two-dimensional protein gel electrophoresis (HR2D) and quantitative analysis to study patterns of change in cellular protein synthesis induced in both rat and human cells in response to several classes of DNA damage. Their findings indicate that several proteins of known cellular function are rapidly induced during the acute phase of cellular response to DNA damage, including proliferating cell nuclear antigen (PCNA) or cyclin and human major histocompatibility class I (MHC-I) proteins.

37388 (CONF-8704370–, pp. 265-274) **Induction of VL30 element expression as a response to anoxic stress.** Anderson, G.R. (Roswell Park Memorial Institute, Buffalo, NY (USA)); Stoler, D.L.; Scott, J.P.; Farkas, B.K. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

VL30 elements have structural properties of transposons and, when pseudotyped by retroviruses, have been shown to be transposable. These elements are particularly interesting in that they represent one of two sets of rat cellular sequences transduced into the genomes of the Kirsten and Harvey murine sarcoma viruses. Anoxic stress induces normal rat fibroblasts to transcribe exceptionally high levels of functional mRNA, corresponding to the VL30 sequences. This stress is relatively mild, with no reduction in cell viability associated with the induction response. One anoxic stress response protein, of 34 kD and with lactate dehydrogenase (LDH) activity, appears likely to be encoded by VL30 sequences. Induction of VL30 RNA is not seen with a variety of other respiratory poisons, with the exception of a low level response to cyanide. The induction by cyanide, however, appears different, being part of a general response to highly toxic conditions. The induction of VL30 seen with cyanide is substantially less than with anoxia and, unlike anoxia, also results in production of endogenous type C leukemia virus.

37389 (CONF-8704370–, pp. 289-298) **Possible role of retrotransposons in carcinogenesis.** Weinstein, I.B. (Columbia Univ. Comprehensive Cancer Center and Institute of Cancer Research, New York, NY (USA)); Hsiao, W.L.; Hsieh, L.; Dragani, T.A.; Peraino, C.; Begemann, M. Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). 1988. DOE Contract W-31-109-ENG-38. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, NY, USA; 21 Apr 1987. In *Eukaryotic transposable elements as mutagenic agents.* Order Number DE89008620/JAW. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

Carcinogenesis involves complex changes in gene expression and the structure of cellular DNA. The DNA of mammalian cells, including humans, contains thousands of copies of endogenous retrovirus-like elements whose structures closely resemble transposable elements found in lower organisms. Because these elements might play a role in multistage carcinogenesis, the authors have carried out detailed studies on their expression during the course of development of carcinogen-induced and spontaneously arising rodent tumors. These studies indicate that carcinogen-induced liver tumor formation in both mice and rats is associated with a striking increase in the expression of endogenous retrovirus-like elements in carcinogen-induced liver tumors. In related studies they found that agents that induce liver cell proliferation cause the transient expression of these sequences. Studies employing cycloheximide and transient expression assays suggest that trans-acting repressor and activator proteins normally regulate the transcription of these sequences. Further studies of this phenomenon may lead to insights into the more widespread aberrations in gene expression often seen in tumors. Studies are also in progress to determine whether the expression of retrovirus-like sequences in tumors also leads, via reverse transcription, to gene transposition and insertion mutations and thus contributes to the process of tumor progression.

37390 (EC–1988, pp. 101-111) **Evaluation of the impact of acid deposition on Eastern Canada's sport fishery.** Simmons, M. (TYDAC Technologies, Inc., Ottawa, ON, Canada); Sayer, R. Environment Canada, Ottawa, ON (Canada). 1988. (CONF-8611291–: Perspectives on land modelling, Toronto, Canada, 17-20 Nov 1986;MICROLOG–88-06350). In *Perspectives on land modelling. Workshop proceedings.* Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Under the Long Range Transportation of Atmospheric Pollutants (LRTAP) program, the Department of Fisheries and Oceans required an estimate of the economic impact of acid deposition on eastern Canada's sport fish industry. The project required a biophysical model to predict the impact of alternative deposition scenarios on

sport fish catch rates. This paper deals with the biophysical model through the biophysical concepts employed, the modelling approach used, and the use of a microcomputer based geographic information system (SPANS) to run the model and display the results. The biophysical model identifies the per cent change in fish availability to anglers under various deposition scenarios, for input to an economic model. The following deposition scenarios were evaluated: 1980 deposition reduced by 25%, and 1980 deposition reduced by 50%. The results, presented in map form, indicate increases in catch of greater than 6% for large tracts of northwestern Ontario and along the north shore of the St. Lawrence. 6 refs., 8 figs.

37391 (OMNR/FB–87-10) **Observations of lake trout (Salvelinus namaycush) spawning behaviour in low pH lakes near Sudbury, Ontario.** Lumatainen, V.A.; Snucins, E.J.; Gunn, J.M. Ontario Ministry of Natural Resources, Toronto, ON (Canada). Fisheries Branch. 1987. 75p. (MICROLOG–88-06153). Available from Ontario Ministry of Natural Resources, Public Information Centre, 99 Wellesley St., West, Toronto, ON, Canada M7A 1W3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The spawning behaviour of lake trout (Salvelinus namaycush) was assessed in 5 low pH (pH 5.1 -5.7) lakes in the Sudbury area and in one circumneutral reference lake. The lake trout in the low pH lakes exhibited recruitment failure with no evidence of successful reproduction for, in some cases, a decade or more. The numbers of native lake trout in the low pH lakes were estimated to be in the range from 2 to 22. The remnant adult populations continued to spawn and produce viable gametes. Selected spawning sites were shallow (6 cm-3 m depth) and usually near shore, making them vulnerable to acidic run-off. Some sites were located well offshore with little potential of expsure to run-off water. Extensive use was made of ultrasonic transmitter tags to locate spawning sites and to provide information about the movements of adults during the spawning period. Additional findings included: egg predation by juvenile hatchery-stocked lake trout; unusual inverted swimming displays by spawning adults; and spawning of mature hatchery-stocked lake trout with native adults. 22 refs., 21 figs., 25 tabs.

37392 (OMNR/FB–87-11) **Preliminary assessment of the current impact and potential risk of acidic deposition on walleye populations in Ontario.** Wales, D.L.; Liimatainen, V.A. Ontario Ministry of Natural Resources, Toronto, ON (Canada). Fisheries Branch. 1987. 55p. (MICROLOG–88-06239). Available from Ontario. Ministry of Natural Resources. Fisheries Branch, Whitney Block, Room 2347, 99 Wellesley St. W., Toronto, ON, Canada M7A 1W3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Netting survey and field bioassay data were used to determine a pH threshold for survival of walleye. Established pH thresholds were then used to assess the current impact and potential risk of acidic deposition on walleye populations in Ontario. Extinction of walleye appeared to occur in lakes with pH < 5.5. Some losses may also have occurred in lakes with pH 5.5-6.0. An estimated 0.3% (number of lakes (N)=12) of the Ontario walleye lakes currently have pH < 5.5 and have likely lost walleye populations. A further 1.5% (N=60) of the lakes have pH 5.5-6.0 and may show signs of acidification stress. An estimated 2.0% (N=79) of the province's walleye lakes have very low alkalinities (0.0-2.0 mg/l) and are classified as extremely sensitive to continued high deposition of acidic precipitation. 19 refs., 4 figs., 7 tabs.

37393 (PB–89-861058/XAB) **Toxicology of ozone. January 1970-March 1988 (Citations from the NTIS data base). Report for January 1970-March 1988.** National Technical Information Service, Springfield, VA (USA). May 1989. 197p. Available from NTISPC N01/MF N01.

See also PB–89-861066.

This bibliography contains citations concerning laboratory and field investigations of the toxic effects of ozone. Topics include effects on forests, agricultural crops, humans, and laboratory animals. Synergism with other atmospheric pollutants such as oxides of sulfur and nitrogen is discussed. Occupational exposure, dosage, and effects on pulmonary and respiratory systems in humans and animals are also presented. (This updated bibliography contains 374 citations, none of which are new entries to the previous edition.)

37394 (PB–89-861066/XAB) **Toxicology of ozone. April 1988-April 1989 (Citations from the NTIS data base). Report for April 1988-April 1989.** National Technical Information Service, Springfield, VA (USA). May 1989. 38p. Available from NTISPC N01/MF N01.

Supersedes PB–88-860275. See also PB–89-861058.

This bibliography contains citations concerning laboratory and field investigations of the toxic effects of ozone. Topics include effects on forests, agricultural crops, humans, and laboratory animals. Synergism with other atmospheric pollutants such as oxides of sulfur and nitrogen is discussed. Occupational exposure, dosage, and effects on pulmonary and respiratory systems in humans and animals are also presented. (This updated bibliography contains 51 citations, all of which are new entries to the previous edition.)

37395 (SCC–8804) **Airborne contaminants and aquatic systems. An assessment of research needs.** Stokes, P. Science Council of Canada, Ottawa, ON (Canada). Committee on Industrial Policies. 1988. 52p. (MICROLOG–89-00940). Available from Science Council of Canada, 100 Metcalfe St., Ottawa, ON, Canada K1P 5M1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Research needs related to deposition of airborne acidic and other chemical pollutants into aquatic ecosystems in Canada are reviewed. Research into acidic deposition in the USA and Canada is summarized, and new approaches are suggested. Mitigation of surface water acidification by means of liming is discussed. An outline is then presented of various interviews conducted with university and government researchers, regarding the roles of governments and universities in water-related research and monitoring, the organization of research, priorities for water-related research, the value of the watershed as a management unit, and budgeting for research and rehabilitation. 48 refs., 4 figs., 1 tab.

37396 **Effects of air pollutants on the composition of stable carbon isotopes $\delta^{13}C$, of leaves and wood, and on leaf injury.** Martin, B. (Native Plants, Inc., Salt Lake City, UT (USA)); Bytnerowicz, A.; Thorstenson, Y.R. *Fishery Bulletin (USA)*, 88(1): 218-223 (Sep 1988).

Air pollutants are known to cause visible leaf injury as well as impairment of photosynthetic CO_2 fixation. Here we evaluate whether the effects on photosynthesis are large enough to cause changes in the relative composition of stable carbon isotopes, $\delta^{13}C$, of plant tissue samples, and, if so, how the changes relate to visual leaf injury. For that purpose, several woody and herbaceous plant species were exposed to $SO_2 + O_3$ and $SO_2 + O_3 + NO_2$ for one month. At the end of the fumigations, the plants were evaluated for visual leaf lesions, and $\delta^{13}C$ of leaf tissue was determined. Woody plants generally showed less visual leaf injury and smaller effects on $\delta^{13}C$ of pollutant exposure than did herbaceous plants. If $\delta^{13}C$ was affected by pollutants, it became, with few exceptions, less negative. The data from the fumigation experiments were consistent with $\delta^{13}C$ analyses of whole wood of annual growth rings from two conifer tree species, Pseudotsuga menziesii and Pinus strobus. These trees had been exposed until 1977 to exhaust gases from a gas plant at Lacq, France. Wood of both conifer species formed in the polluted air of 1972 to 1976 had less negative $\delta^{13}C$ values than had wood formed in the much cleaner air in 1982 to 1986. No similar, time-dependent differences in $\delta^{13}C$ of wood were observed in trees which had been continuously growing in clean air. Our $\delta^{13}C$ data from both relatively short-term artificial exposures and long-term natural exposure are consistent with greater stomatal limitation of photosynthesis in polluted air than in clean air.

37397 **Physiological aspects of deposition of trace gases to leaves.** Taylor, G.E. Jr. (Environmental Sciences Div., Oak Ridge National Lab., Oak Ridge, TN (US)); Hanson, P.J. *Bulletin of the Ecological Society of America (USA)*, 68(3): 427 (Jul 1987). (CONF-870835–: 72. annual meeting of the Ecological Society of America, Columbus, OH, USA, 9-14 Aug 1987).

The exchange of trace gases between the atmosphere and leaf surfaces in a central issue in research addressing the physiological and ecological consequences of air pollution stress. Experimental approaches to characterizing deposition include gas exchange measurements in chambers, isotope labeling, chemical analysis of plant tissues and leachates, process-level modeling, and micrometeorology. The most common technique utilizes the mass balance

approach in chambers operating at the individual-leaf, whole-plant, or canopy level. With attention to experimental design, research can address foliar sites of deposition (leaf surface vs leaf interior) and the role of cuticular, stomatal, and residual resistances. An understanding of deposition is essential for characterizing (1) mechanisms of injury , (2) physiological bases of genetic variation in plant response, (3) biologically effective features of air chemistry, and (4) significance of dry deposition in the biogeochemistry of terrestrial landscapes.

5604 Other Environmental Pollutant Effects

37398 (AD-A–204724/9/XAB) **Eligibility of noise-abatement proposals for grants-in-aid under the airport improvement program.** Ohnstad, E. Federal Aviation Administration, Washington, DC (USA). Office of Airport Planning and Programming. Jan 1989. 26p. (DOT/FAA/PP–89-2). Available from NTIS, PC A03/MF A01.

This report summarizes the provisions of existing Federal laws, regulations, administrative policies, and grant-program procedures that relate to funding of noise-abatement projects. The report also presents historical data on Federally assisted noise compatibility projects and funding levels in fiscal years 1982 - 1987. A literature search was conducted and parties involved with airport-noise compatibility planning and project implementation were consulted to identify proposals currently not eligible for grant assistance and the reasons for their ineligibility. The report concludes with recommendations to make eligibility criteria more flexible and to provide clearer guidance to parties involved with noise compatibility project formulation, evaluation and implementation.

37399 (AD-A–205280/1/XAB) **Examination of noise-management approaches in the United States. Final report.** Berrens, R.P.; DeWitt, J.S.; Baumann, D.D.; Nelson, M.E. Planning and Management Consultants Ltd., Carbondale, IL (USA). Dec 1988. 213p. Available from NTIS, PC A10/MF A01.

This report is intended to serve as a reference document on noise-management approaches used in the United States. Emphasis has been placed on identifying and evaluating the full range of techniques and measures available when selecting a noise-management strategy. Broadening the range of choice is a first step in moving toward the resolution and prevention of noise/land-use conflicts. Awareness of the available options is of critical importance when individual actors in an issue have limited unilateral power to achieve objectives. The first three chapters of the report provide the reader with background material designed to aid in the understanding of noise-management issues. A brief description of the noise problem in the U.S. is given, followed by a discussion on conceptual approaches to noise/land-use issues. Some basic concepts of sound and the measurement and assessment of noise are reviewed. In addition, the management application of noise descriptors, relating human responses to noise-exposure levels, is examined. In Chapter III, a change is made from describing the noise environment, to describe the legal framework of statutory and case law that shapes management policy. Chapters 4 through 6 are devoted to identifying and evaluating management approaches.

37400 (PB–89-860670/XAB) **Laser materials: radiation damage. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989.** National Technical Information Service, Springfield, VA (USA). May 1989. 165p. Available from NTISPC N01/MF N01.

Supersedes PB–88-862909.

This bibliography contains citations concerning laser-beam damage to laser materials, including optical glass, mirrors, optical coatings, dielectrics, semiconductors, and alkali metal halides. The damage mechanisms are explored for various types of laser materials. Comparisons are made between variations in fabrication and preparation of the materials and the resulting degradation or damage to the materials. (This updated bibliography contains 323 citations, 10 of which are new entries to the previous edition.)

57 HEALTH AND SAFETY

Refer also to citation(s) 37150

37401 (CONF-8906144–1) **Insurance and bonding.** Katzman, M.T. Oak Ridge National Lab., TN (USA). 1989. 39p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From Conference on free and responsible individual vs. prior restraint; Bozeman, Montana, USA; 8-11 Jun 1989. Order Number DE89013709/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Societal risk management in industrial democracies relies upon mechanisms of prior restraint rather than on responsibility for the consequence of accidents. The evolution of risk management from one based upon private, voluntary standard of risk management from one based upon private, voluntary standard setting to one based upon restraint is reviewed. While insurance and bonding historically have played a major role in private management of catastrophic risks, their role has been underutilized in the current, restraint-based mode. The conditions under the insurance and bonding that can serve as a tool for risk regulation are illustrated in the arena of toxic pollution risks. 45 refs., 1 fig.

37402 (SAND–89-0889) **Guidelines for preparing a contractor safety plan.** Lucy, W. Sandia National Labs., Albuquerque, NM (USA). Jul 1989. 13p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89014613/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report contains guidelines for SNLA contractors who must prepare contractor safety plans in compliance with Sandia's requirements.

58 GEOSCIENCES

5801 Geology and Hydrology

Refer also to citation(s) 37248

37403 (CNEA-NT–25/87) **Geological and geophysical investigations at Sierra del Medio massif - Argentine.** Perucca, J.C.; Llambias, E.; Puigdomenech, H.H.; Cebrelli, E.; Castro, C.E.; Grassi, I.; Salinas, L.I. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Gerencia de Proteccion Radiologica y Seguridad. 1987. 13p. (CNEA-REPO–29). Order Number DE89619706/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Work presented at the 5o. Congreso Internacional sobre Geologia Aplicada a la Ingenieria, Buenos Aires (Argentina), 20-25 octubre 1986.

Geological investigations were performed at Sierra del Medio (Chubut Province), a mountainous massif of about 25 km by 8 km of migmatic origin, which emerges from a depressed tectonic trench or graben called Pampa de Gastre. The most ancient rocks belong to biotitic and anphibolic schist that passed almost entirely to tonalitoid migmatites with a second process producing granitic rocks. Boreholes were drilled on the basis of conclusions from Landsat satellites imagery and aerial photographic sets, folowed by field work on geological, petrographic, geophysical and hydrogeological features at surface, structural interpretation supported by geostatistical computations. Two sets of boreholes were drilled to investigate subsurface rock behaviour al 300 m depth and 800 m depth respectively, beginning at peripheral places and ending at the central part or selected site. Basic purposes of boreholes were to define structural and petrographic features of the rock massif by a good comprehension of master joints and faulting distribution with its belts of alteration mylonitization or brecciation, mechanical properties of samples, chemical composition and varitions, petrographic facies and mineralogy. Boreholes provided data to investigate joints, faults and dikes as general discontinuities for hydraulic research like permeability or effective hydraulic conductivity, and their geostatistical modelling. Boreholes are also being prepared for geophysical logging from which logthermal ones have already been completed.

37404 (DOE/ER/13796–3) **Comparison of spectral data gathered from a laboratory spectrometer and TM images with and without shadow correction.** Thiessen, R.L.; Eliason, J.R. Washington State Univ., Pullman, WA (USA). Dept. of Geology. 1989. 5p.

Sponsored by DOE Energy Research. DOE Contract FG06-87ER13796. (CONF-890768–1: International geoscience and remote sensing symposium, Vancouver, Canada, 10-14 Jul 1989). Order Number DE89010877/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

Spectral reflectance data from field samples were determined with a laboratory spectrometer (Beckman DK-2A). The spectral curves obtained with the spectrometer were correlated with the histograms determined from the images. The tightly defined histograms from the shadow corrected TM provided the best correlation with the rock data. Several units, including the Rainier Mesa Member of the Timber Mountain Tuff, showed multiple spectral patterns on both images and rock spectra. This difference was evaluated versus geochemistry, hematitic alteration, devitrification, pumice content, and degree of welding. 11 refs., 3 figs., 3 tabs.

37405 (IAEA-R–4531-F) **$^{230}Th/^{234}U$ dating of the quaternary spring travertines in the Arava Rift Valley of Israel and paleoclimatic implications. Final report for the period 15 December 1986 - 15 December 1987.** Kronfeld, J. Tel Aviv Univ. (Israel); International Atomic Energy Agency, Vienna (Austria). Jul 1988. 51p. Order Number DE89617881/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Springs and lake deposits (travertines) sampled along the western margins of the Arava segment of the Dead Sea Rift Valley, Israel, were studied as a potential source of palaeoclimatic information. The $^{230}Th/^{234}U$ disequilibrium method was used to determine the age of the investigated deposits. The radiometric dating was supplemented by detailed petrographic and chemical analyses of the collected samples. Detailed petrographic observations of the analysed travertine samples suggest their deposition under moderately-arid conditions, alternating with arid to extremely arid periods. This evidence is consistent with the preliminary conclusions drawn from palynological studies in the area. Dating by the $^{230}Th/^{234}U$ disequilibrium method indicates that most travertine ages correspond to oceanic ^{18}O stages 5 and 7. The good correspondence between apparent ages as deduced from the position of the travertines in vertical and lateral successions and the radiometric ages, lends credibility to the radiometric ages. The clustering of ages during the warm ^{18}O stages bears similarity to the temporal distribution of middle to late Pleistocene sapropelic horizons in the Eastern Mediterranean Basin which further leads to suspicion that during insolation maxima monsoonal cells originating in the Indian Ocean have shifted northwards reaching the latitude of the Arava and Negev Highlands. Refs and figs.

37406 (ORNL/FTR–2945) **Thirteenth radioactive conference, radiocarbon measurements and applications, Dubrovnik, Yugoslavia, June 20–25, 1988: Foreign trip report.** Peng, T.H. Oak Ridge National Lab., TN (USA). 8 Jul 1988. 13p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014058/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

The International Radiocarbon Conference is held once every three years. The purpose of the meeting is to offer an opportunity for an international community of scientists to present and discuss results of their research on improving techniques for radiocarbon measurement and their application in various aspects of natural systems, including the ocean-atmosphere carbon cycle. Four major sessions were held for the presentation of scientific results, another session dealt with radiocarbon data bases, and the final session was devoted to workshops for radiocarbon measurement and international comparison. A total of 152 papers were presented, which included both oral and poster presentations. Participants came from over 30 countries, with a total number of about 200. The paper presented by the traveler, entitled "Changes in Ocean Ventilation Rates Over the Last 7000 Years Based on ^{14}C Variations in the Atmosphere and Oceans," was included in the oceanography portion of the Carbon Cycle in the Environment session. Radiocarbon is the most powerful and useful tracer for studying the carbon cycle in the atmosphere-biosphere-ocean system. The measuring technique has mostly shifted from a conventional β-counting approach that uses gas or liquid scintillation counters to an atom counting approach that uses the accelerator mass spectrometer.

37407 (USGS-BULL–1831) **Index of granitic rock masses in the state of Nevada: A compilation of data on 205 areas of exposed granitic rock masses in Nevada.** Geological Survey, Denver, CO (USA). 1988. 81p. Sponsored by DOE Nuclear Energy. DOE Contract AI08-78ET44802. Order Number DE89014818/JAW. Available from NTIS, PC A06/MF A01; OSTI - USGS, Federal Center, Box 25425, Denver, CO 80225; GPO Dep.

The compilation of 205 areas of exposed granitic rock in Nevada was undertaken for the US Department of Energy. The purpose was to obtain data for evaluating granitic rock masses as potential underground nuclear waste repositories. Information, compiled by county for areas of granitic rock exposure, includes general location, coordinates, land classification, areal extent, accessibility, composition, age, rocks intruded, aeromagnetic expression, mining activity, and selected references. 49 refs., 18 figs., 3 tabs.

5802 Geophysics

37408 (IC–88/424) **Seismic zoning in India.** Agrawal, R.C. International Centre for Theoretical Physics, Trieste (Italy). Dec 1988. 23p. Order Number DE89619707/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

After a very brief presentation of the concept and procedures for dealing with earthquake data for seismic zoning studies, the seismic zoning studies in India are described in detail. 26 refs, 8 figs.

37409 (IC–89/18) **Paleomagnetic study of Shanwang formation, Shandong Province, China.** Liu Huangfeng; Shi Nin. International Centre for Theoretical Physics, Trieste (Italy). Jan 1989. 12p. Order Number DE89619708/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The measured direction of the stable remanence of Shanwang Formation, Shandong Province, is D = 355.8 deg., I = 47.1 deg. According to the axial geocentre dipole model, the paleolatitude there during Miocene was 28.3 deg. N. The corrected value based on far-sided effect is 32.4 deg. N. The uncorrected and corrected pole positions were (81.0 deg. N, 323.1 deg. E) and (84.6 deg. N, 339.7 deg. E) separately. Comparing them with paleo-flora shows that the corrected value of paleolatitude is probably reasonable. (author). 14 refs, 3 figs, 1 tab.

37410 (LA-UR–89-1928) **Computer simulations of explosive volcanic eruptions.** Wohletz, K.H.; Valentine, G.A. Los Alamos National Lab., NM (USA). 1989. 40p. Sponsored by DOE/DP;DOE/ER. DOE Contract W-7405-ENG-36. (CONF-890702–3: 28. international geological congress, Washington, D.C., USA, 9-19 Jul 1989). Order Number DE89014024/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We have adapted computer codes that provide such solutions to study explosive volcanic phenomena. These fully nonlinear conservation equations are cast in two-dimensional cylindrical coordinates, which with closure equations comprise 16 equations with 16 unknown variables. Solutions for several hundred seconds of simulated eruption time require two to three hours of a Cray-1 computer time. Over 100 simulations have been run to simulate the physics of highly unsteady blasts, sustained and steady Plinian eruptions, fountaining, column eruptions, and multiphase flow of magma in lithospheric conduits. The unsteady-flow calculations show resemblance to shock-tube physics with propagation of shock waves into the atmosphere and rarefaction waves down the volcanic conduit. Steady-flow eruption simulations demonstrate the importance of supersonic flow and over pressure of erupted jets of tephra and gases in determining whether the jet will buoyantly rise or collapse back to the earth as a fountain. Flow conditions within conduits rising through the lithosphere determine eruptive conditions of overpressure, velocity, bulk density, and vent size. Such conditions within conduit systems are thought to be linked to low-frequency, sustained seismicity known as volcanic tremor. These calculations demonstrate the validity of some analytical eruption calculations under limited conditions. 31 refs., 10 figs., 1 tab.

37411 (NUREG/CR–5375) **Post-Pennsylvanian reactivation along the Washita Valley fault, southern Oklahoma.** VanArsdale, R.; Ward, C.; Cox, R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Arkansas Univ., Fayetteville, AR

(USA). Dept of Geology. Jun 1989. 53p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A04/MF A01 - GPO - OSTI.

Surface exposures of faults of the Washita Valley fault (WVF) system in Garvin, Murray, Carter, and Johnston counties of southern Oklahoma were studied to determine if there has been post-Pennsylvanian fault reactivation and to determine if there has been any Quaternary fault movement. This was undertaken through field mapping, by dating alluvium which overlies the faults, and by logging trenches excavated across the WVF. In northern Murray County and southern Garvin County (site A), the WVF displaces Late-Pennsylvanian Oscar Group showing post-Pennsylvanian movement; however, no faulting was observed in 2000 year old alluvium of Wildhorse Creek along strike of the WVF. Three sites (B, C, and D) are located within the Arbuckle Mountains. Faulting of Virgilian age Vanoss Conglomerate and Vanoss Shale reveal post-Virgilian (Late Pennsylvanian) activity along a subsidiary fault in northern Murray County (site B). A 12000 to 15000 year old terrace at this site is unfaulted. Absence of any fault related features in paleosols which overly the WVF along the Washita River (site C) show that the fault has not been active during the last 1570 $\pm$ 190 years in southern Murray County. Similarly, absence of any fault related features along Oil Creek (site D) indicates that the WVF has not been active during the last 1810 $\pm$ 80 years in northern Carter and Johnston Counties. Faults in the Antlers Sandstone in southern Johnston County (site E) reveal post-Lower Cretaceous reactivation of the WVF. 49 refs., 28 figs., 1 tab.

37412 (SAND–89-0155) **Science guide for the Long Valley Caldera deep hole.** Rundle, J.B.; Eichelberger, J.C. (eds.). Sandia National Labs., Albuquerque, NM (USA). May 1989. 88p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE89013332/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The Magma Energy Program of the US Department of Energy, Geothermal Technology Division, is planning to begin drilling a deep (6 km) exploration well in Long Valley Caldera, California, in September 1988. The location of the well is in the central part of the caldera, coincident with a large number of shallow (5-7 km) geophysical anomalies identified through many independent investigations. Results from the hole will permit the following: direct investigation of the geophysical anomalies interpreted to be magma; investigation of the patterns and conditions of deep fluid circulation and heat transport below the caldera floor; determination of the amount of collapse and subsequent resurgence of the central portion of Long Valley caldera; and determination of the intrusion history of the central plutonic complex beneath the caldera, and establishment of the relationship of intrusive to eruptive events. The hole will thus provide a stringent test of the hypothesis that magma is still present within the central plutonic complex. If the interpretation of geophysical anomalies is confirmed, the hole will provide the first observations of the environment near a large silicic magma chamber. 80 refs., 7 figs., 2 tabs.

37413 (SAND–89-1366C) **Research drilling in young silicic volcanoes.** Eichelberger, J.C. Sandia National Labs., Albuquerque, NM (USA). 1989. 37p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-890702–2: 28. international geological congress, Washington, DC, USA, 9-19 Jul 1989). Order Number DE89014187/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Magmatic activity, and particularly silicic magmatic activity, is the fundamental process by which continental crust forms and evolves. The transport of magma from deep crustal reservoirs to the surface is a neglected but important aspect of magmatic phenomena. It encompasses problems of eruptive behavior, hydrothermal circulation, and ore deposition, and must be understood in order to properly interpret deeper processes. Drilling provides a means for determining the relationship of shallow intrusive processes to eruption processes at young volcanoes where eruptions are best understood. Drilling also provides a means for directly observing the processes of heat and mass transfer by which recently emplaced intrusions approach equilibrium with their new environment. Drilling in the Inyo Chain, a 600-year-old chain of volcanic vents in California, has shown the close relationship of silicic eruption to shallow dike emplacement, the control of eruptive style by shallow porous-flow degassing, the origin of obsidian by welding, the development of igneous zonation by viscosity segregation, and the character and size of conduits in relation to well-understood magmatic and phreatic eruptions. 36 refs., 9 figs.

37414 (SKB-TR–88-25) **Postglacial faulting and paleoseismicity in the Landsjaerv area, northern Sweden.** Lagerbaeck, R. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Oct 1988. 44p. Order Number DE89783579/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Post-glacial fault scarps, up to about 20 m in height and forming a 50 km long fault set with a SSW-NNE orientation, occur in the Lansjaerv area in northern Sweden. By trenching across the fault scarps it has been possible to date fault movement relative to the Quaternary stratigraphy. It is concluded that the fault scarps generally developed as single event movements shortly after the deglaciation about 9000 years ago. At one location there are indications that minor fault movements may have occurred earlier during a previous glaciation but this is uncertain. The fault scarps are, at least partially, developed in strongly fractured and chemically weathered zones of presumed pre-Quaternary age. To judge from the appearance of the bedrock fault scarps, and the deformation of the Quaternary deposits, the faults are reverse and have dips between some 40-50^0 and the vertical. The faulting was co-seismic and earthquakes in the order of M 6.5-7.0, or higher, are inferred from fault dimensions and the distribution of seismically triggered landslides in a wider region. Distortions in different types of sediment, interpreted as caused by the influence of seismic shock, occur frequently in the area. Examples of these are briefly described.

5803 Mineralogy, Petrology, and Rock Mechanics

Refer also to citation(s) 35734, 35735, 35747

37415 (AOSTRA–8808, pp. 14) **Modelling of fracture and deformation processes in oil sands.** Settari, A. (SIMTECH Consulting Services Ltd., Calgary, AB, Canada). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1988. (CONF-880807–: 4. UNITAR/UNDP international conference on heavy crude and tar sands, Edmonton, Canada, 7-12 Aug 1988;CE–02589). In *UNITAR/UNDP, 4th international conference on heavy crude and tar sand, vol. 1.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.

Injection into unstimulated heavy oil reservoirs generally results in fracturing and disturbance of the soil matrix. Prediction of the fracture dimensions requires correct representation of a number of mechanisms. Parametric analysis shows that the process is dominated by fluid flow, which is, in turn, controlled by the non-linear mechanical behavior of the sands. Other phenomena that are necessary for realistic modelling are shear failure at the fracture face, turbulent flow in the fracture, tip resistance to fracture propagation, and back-stress. The new modelling system consists of a detailed model of coupled flow and soil mechanics and a model of fracture propagation. A method has been developed for translating the results of the detailed model for the calculation of the fluid leak-off from the fracture to the reservoir, into the simplified leak-off with effective parameters used in the fracturing model. The new modelling system based on these principles is very efficient, and compares favorably with the field data in terms of fracture dimensions and widths, and the extent of the failure zone. 33 refs., 10 figs., 1 tab.

37416 (NEI-DK–167) **Pressure-dependent melting curve of natural carnallite, $KMgCl_3.6H_2O$, in a closed system, where evaporation is prevented.** Fabricius, J.; Rose-Hansen, J. Danmarks Geologiske Undersoegelske, Copenhagen (Denmark); Copenhagen Univ. (Denmark). 1988. 8p. (CONF-8705377–: 9. symposium on fluid inclusions, Oporto, Portugal, 4-6 May 1987). Order Number DE89776127/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

EFP-84.

The evaporite mineral carnallite, $KMgCl_3x6H_2O$, melts incongruently at 167.5 deg. C under atmospheric pressure in a closed

space, where evaporation is prevented. The incongruent melting results in a melt consisting of $MgCl_2x6H_2Ox0.25$ KCl plus solid KCl. Fluid incongruent of the Na-K-Mg-Cl-H_2O system with daughter carnallite, trapped in quartz crystals from Danish Zechstein 2 salt, were studied by means of microthermometry. The liquid shrinkage vapour bubble disappears during heating at a lower temperature T_b deg. C than the melting/dissolving temperature T_m deg. C of the carnallite component. The pressure built-up in the inclusion at T_m is calculated from the equation $P = (T_m-T_b)dP/dT$ MPa, where dP/dT ranges from 1.04 MPa/deg. C to 1.08 MPa/deg. C, depending on the salinity and T_m, i.e., homogenization in fluid phase. The pressure dependent melting curve up to c. 150 MPa can be expressed by the formula T_m deg. C = 167.5 deg. C + (dT/dP)P deg. C, where dT/dP = 0.1 deg. C/MPa. Small cores, 10x2.5 cm, of the salt mentioned above, containing disseminated subhedral single crystals of carnallite, were subjects for autoclave studies. Thick sections (1 mm) of the autoclaved cores were examined under the microscope in order to observe the reaction of the grains of carnallite. The grains were compared with grains in thick sections from the same core before autoclavation. Melted grains are easily identified: release of a small amount of solution; polycrystalline appearance; release of high pressure gas, dissolved in the original grain of carnallite. As a rule, also the mineral bischoffite, $MgCl_2x6H_2O$, forms after melting of carnallite. The mean dT/dP value is calculated to 0.10 deg. C/MPa in the interval 0.08 - 0.12 deg. C/MPa, with the uncertainties +/- 2 deg. C and +/- 1 MPa. (author) 20 refs.

5804 Geochemistry

Refer also to citation(s) 35821

64 PHYSICS I

37417 (ILL–88CA03G) **1987 ILL experimental reports and theory college activities.** Castets, C. (ed.). Institut Laue-Langevin, 38 - Grenoble (France). Mar 1988. 545p. Order Number DE89776438/JAW. Available from NTIS (US Sales Only), PC A23/MF A01.

Research in fundamental and nuclear physics; structural and magnetic excitations; crystallography and metallic structures; liquids, disordered materials, and metal physics; biology; and the chemistry of small molecules and large molecules (colloids, polymers) is summarized.

37418 (INIS-mf–11440) **Advances in Physics.** Central Inst. of Physics, Bucharest (Romania). 1988. 828p. (In Rumanian). (CONF-8810372–: Advances in physics, Constanta, Romania, 6-8 Oct 1988). Order Number DE89012158/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Individual papers are separately indexed.

37419 (INIS-SU–87/A) **Physical experiment technique. Scientific-technical collection.** Voprosy atomnoj nauki i tekhniki. no. 4(35). Kurilko, V.I. (ed.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. 82p. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). Order Number DE89012157/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Individual papers in this collection are indexed separately.

37420 (INIS-SU–94/A) **Experimental and theoretical physics.** Kratkie soobshcheniya po fizike. no. 8. AN SSSR, Moscow (USSR). Fizicheskij Inst. 1988. 54p. (In Russian). Order Number DE89012156/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

Individual papers are separately indexed.

6401 Astrophysics and Cosmology

Refer also to citation(s) 37493, 37517, 37583, 37636, 37711

37421 (AD-A–205161/3/XAB) **Precise proper-motion measurement of solar granulation.** November, L.J.; Simon, G.W. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 1 Oct 1988. 18p. (AFGL-TR–89-0046). Available from NTIS, PC A03/MF A01.

Pub. in the Astrophysical Jnl., Vol. 333, No. 1, Part 1, 427-442(1 Oct 1988).

A powerful cross-correlation technique is described for the precise measurement of the proper motion of tracers seen on successive images of a time series of solar granulation. The cross correlation is defined as a function of position in the image, within a spatially localized apodization window. The time average of the spatially localized cross correlation gives a measure of the displacement that is not biased by atmospheric seeing. The window size and the seeing define the effective resolution of the vector-displacement determination. We use this cross-correlation technique to analyze an 80 minute run of white-light observations made at the Sacramento Peak Vacuum Tower Telescope. Even though geometric distortion due to atmospheric seeing is instantaneously at least 10-20 times larger than the observed scale of the large-scale solar displacements, 100-1000 m/s , its net contribution to the 80 minute average of proper motions is RMS $<$ 20 m/s. The measured vector displacement clearly show solar mesogranulation and super-granulation flows having spatial scales from 10 min to 40 min. The measured amplitude of these flows is significantly larger than the RMS 100 m/s noise which we attribute principally to solar granulation evolution.

37422 (AD-A–205162/1/XAB) **Temporal variations of solar-spectral-line profiles induced by the 5-minute photospheric oscillation.** Gomez, M.T.; Marmolino, C.; Roberti, G.; Severino, G. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 1987. 10p. (AFGL-TR–89-0050). Available from NTIS, PC A02/MF A01.

Pub. in Astronomy and Astrophysics, Vol. 188, 169-177(1987).

The variations induced by the 5-min photospheric oscillation are simulated on the line profiles. A phase lag of the order of 150° between temperature and velocity wave perturbations can explain the observed differences between the oscillations of the line flanks at residual intensity levels $I/I_c < 0.7$. Such a phase relation in the 5-min oscillation differs from that of the adiabatic case in which the temperature and pressure fluctuations are 90° out of phase with respect to the velocity. A simple model of radiative damping in the solar photosphere can produce the required phase lag between temperature and velocity. The granulation can affect differentially the oscillations of the line flanks. This effect, however, does not fit the observed behavior of the flank oscillations.

37423 (AD-A–205182/9/XAB) **Study of fine-scale solar dynamics. Final report, 6 September 1985-31 October 1988.** Acton, D.S.; Smithson, R.C.; Roehrig, J.R.; Sharbaugh, R.J. Lockheed Missiles and Space Co., Inc., Palo Alto, CA (USA). Research and Development Div. 23 Oct 1988. 21p. (LMSC/F–285448). Available from NTIS, PC A03/MF A01.

A description of the new Lockheed 57-actuator segmented active mirror is given. Observational results from four observing runs at Sac Peak with the active mirror are presented, along with a Fourier analysis of these results. The active mirror is shown to be capable of producing near-diffraction limited results in average seeing conditions.

37424 (AD-A–205232/2/XAB) **Study of weak solar magnetic fields. Final report, 1 December 1987-30 November 1988.** Zirin, H. California Inst. of Tech., Pasadena, CA (USA). 1989. 2p. Available from NTIS, PC A02/MF A01.

There have been two major gains in this period: completion and analysis of round-the-clock observations in cooperation with the Huairou Observatory in the People's Republic of China, which enabled the author to obtain the first long-term observations of weak solar magnetic fields, and the application of the magneto-optic filter to the measurement of magnetic fields. The observations in collaboration with China enabled observations for as long as seven days of solar magnetic regions, with only short interruptions when the sun could not be seen from the U.S. and China. The stronger elements of the chromospheric network are rather long lived, lasting about 70 hours. In fact, it is possible that they last longer; because, although the shape changes; it is often possible to still identify a magnetic entity. The second important result was that one could find definite evidence of magnetic field cancellation occurring after solar flares.

The increased time coverage enabled checking the evolution of the magnetic fields during this period. The other development, the use of the magneto-optic filter, is full of promise for the future. This filter is made by using a glass tube filled with potassium which is placed in a strong magnetic field. It enables us to obtain a passband of about 30 milliAngstroms to be obtained at the potassium resonance line at 7699 Angstroms. This filter will take magnetograms of sensitivity higher than that obtained before; the only limitation is on the position of the passband which is fixed until an electromagnet is obtained to vary the magnetic field strength. The magneto-optic filter will enable measurements of solar magnetic fields to proceed much further.

37425 (BNL–42627) **Synchrotron x-ray fluorescence analyses of stratospheric cosmic dust: New results for chondritic and nickel-depleted particles.** Flynn, G.J.; Sutton, S.R. Brookhaven National Lab., Upton, NY (USA). Jun 1989. 19p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8903111–4: Lunar planetary science conference, Houston, Texas, USA, 12-18 Mar 1989). Order Number DE89014032/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Trace element abundance determinations were performed using synchrotron x-ray fluorescence on nine particles collected from the stratosphere and classified as "cosmic". Improvements to the Synchrotron Light Source allowed the detection of all elements between Cr and Mo, with the exceptions of Co and As, in our largest particle. The minor and trace element abundance patterns of three Ni-depleted particles were remarkably similar to those of extraterrestrial igneous rocks. Fe/Ni and Fe/Mn ratios suggest that one of these may be of lunar origin. All nine particles exhibited an enrichment in Br, ranging form 1.3 to 38 times the CI concentration. Br concentrations were uncorrelated with particle size, as would be expected for a surface correlated component acquires from the stratosphere. 27 refs., 4 figs., 2 tabs.

37426 (CBPF-NF–060/88) **Black-hole decay and topological stability in quantum gravity.** Rodrigues, L.M.C.S.; Soares, I.D.; Zanelli, J. Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ (Brazil). 1988. 18p. Order Number DE89618785/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In the context of Quantum Gravity, the evolution of Schwarzschild black-holes is studied. The superspace of the theory is restricted to a class of geometries that contains the Schwarzschild solution for different masses as well as other geometries with different topologies. It is shown that, black-holes are topologically stable under quantum fluctuations but unstable under quantum processes of emission and absorption of gravitons. It is found that, the probability of emission behaves as exp (- α (M_f - M_i)), where M_i and M_f are the masses associated to the initial and final states, respectively and α is a positive constant of the order of 1. As the black-hole looses mass it evolves towards a state corresponding to a black-hole of very small that cannot be distinguished from a pure graviton state.

37427 (ESA-SP–281, pp. 89-92) **Jovian equatorial H_2 emission from 1979-1987.** McGrath, M.A. (Johns Hopkins Univ., Baltimore, MD (US)); Moos, H.W.; Ballester, G.E.; Coplin, K.A. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Ninety two IUE observations of the Jovian equatorial region taken by Johns Hopkins University observers between 2 Dec 1978 and 1 Feb 1988 were averaged together by date of observation, resulting in 22 averaged spectra which were fit with a model to determine the amount of H_2 Lyman band emission in the region 1552-1624A. The data suggest that the H_2 emission may vary with time. Especially suggestive is the marked downward trend of the emission between 1983 and 1987, during which time the strength of the emission in the 1552-1624A region decreased by about a factor of 10. Uncertainty in the existing data and a gap in the data in 1980 and 1981 preclude a positive identification of a correlation between the brightness of the H_2 emission and the major solar cycle.

37428 (ESA-SP–281, pp. 97-102) **Phenomenological analysis of Jovian north auroral H_2 Lyman band emissions.** Livengood, T.A. (Johns Hopkins Univ., Baltimore, MD (US). Dept. of Physics and Astronomy); Moos, H.W.; Ballester, G.E. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Low-dispersion spectra taken with the IUE SWP from 1981-88 are examined for gross longitudinal features in Jovian north auroral emission activity and for evidence of long-term trends in auroral characteristics. Integrated photon flux in the H_2 Lyman-band region is extracted from each of the spectra, characterizing auroral emission strength at time of exposure. A plot of flux vs. Jovian central meridian longitude (System III) corroborates an enhanced emission region centered at about 180^0 reported by Skinner et al., (1984). Curves fit to fluxes grouped as "scans" (consecutive exposures made over a single Jovian rotation) vs. longitude characterize width, position and intensity of the enhanced region. Study includes examination of possible long-term variation in auroral peak intensity and width of the enhanced region vs. time, as well as possible correlation of the light curve integrated over longitude as a measure of total power emitted, vs. the longitudinal position of the intensity peak; more energetic aurorae appear to peak at values of central meridian longitude lower than the previously reported 180^0. An analysis is made of longitudinal dependence in the ratio of photon flux in the Lyman and Werner bands, an indicator of primary particle energy.

37429 (ESA-SP–281, pp. 115-117) **Spectral evolution of SN 1987A in the IUE long wavelength range.** Sanz Fernandez de Cordoba, L. (Instituto Nacional de Tecnica Aerospacial, Madrid (ES)); Cassatella, A.; Gilmozzi, R.; Wamsteker, W.; Kirshner, R.; Panagia, N.; Sonneborn, G. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

IUE low resolution spectra of SN 1987 A, in the long wavelength range, (1952 - 3348A), obtained in the period Feb 25, 1987 - Mar 17, 1988, have been analyzed to study its spectral evolution. We study the spectral variations by comparing spectra obtained at two consecutive observing dates.

37430 (ESA-SP–281, pp. 117-120) **IUE observations of oxygen-rich supernova remnants.** Raymond, J.C. (Harvard-Smithsonian Center for Astrophysics, Cambridge, MA (US)); Blair, W.P.; Danziger, J.; Matteucci, F. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Oxygen-rich supernova remnants present an opportunity to observe material ejected in type II supernova explosions. IUE observations help to determine the composition of the ejecta (specially C and Si abundances) and to test models for the ionization and excitation of the ejecta. We present UV observations of two oxygen-rich supernova remnants (N132D in The Large Magellanic Cloud and 1E 0102-7219 in the Small Magellanic Cloud) and discuss the similarities and differences between them.

37431 (ESA-SP–281, pp. 127-132) **Far UV observations of black hole candidates: the case of LMC X-3.** Treves, A. (Milan Univ. (IT). Ist. di Fisica); Belloni, T.; Maraschi, L.; Bouchet, P.; Falomo, R.; Chiappetti, L.; Tanzi, E.G. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

In this paper we first review briefly the observations of the two sources which have a massive non collapsed component, namely Cyg X-1 and LMC X-1. Then we consider A0620-00 and LMC X-3, whose visible component is much less luminous. The discussion will be focussed in particular on the latter object, because of its non-transient nature, and the important role of UV observations in clarifying the nature of the accretion disk around the hole.

37432 (ESA-SP–281, pp. 133-136) **IUE spectrophotometry of the accretion disk of HZ Her/Her X-1.** Boyle, S.J. (University Coll., London (GB). Dept. of Physics and Astronomy); Howarth, I.D. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

We present IUE low resolution spectra of the accretion disc of the X-ray binary HZ Her/Her X-1. The UV flux contribution from the subgiant companion HZ Her was predicted, using a model constrained by fits to B-magnitude photometry, and subtracted from the observed IUE spectra to leave accretion disc spectra. We compare the observed disc UV fluxes with those predicted by a simple model of the disk emission based on X-ray reprocessing.

37433 (ESA-SP–281, pp. 137-140) **Simultaneous IUE, exosat, and optical observations of the unusual AM Her type variable H0538+608.** Shrader, C.R. (National Aeronautics and Space Administration, Greenbelt, MD (US). Goddard Space Flight Center); Remillard, R.; Silber, A.; McClintock, J.E.; Lamb, D.Q. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

We report on simultaneous observations of the AM Her type variable H0538+608 made with IUE, EXOSAT, and the 1.3 m McGraw-Hill Observatory telescope. Subsequent optical spectrophotometry at high and low resolution was also performed. The X-ray and optical data show clear evidence of a 3.30^{+}-0.03 hour period. Three SWP spectra were taken outside of eclipse and during overlapping phase intervals. The UV spectra contain strong emission lines characteristic of this class of objects and a flat continuum which appears to be deficient, given the brightness of source at optical and X-ray wavelengths. There is evidence for intensity variations in emission lines, particularly CIV. The X-ray light curves for H0538+608 reveal some interesting behavior which may be related to irregularities in its acretion flow.

37434 (ESA-SP–281, pp. 141-144) **0535+26/HDE 245770 - a typical Be/X-ray transient system: coordinated multiwavelength twelve years monitor.** Giovannelli, F. (Consiglio Nazionale delle Ricerche, Frascati (IT). Lab. di Astrofisica Spaziale); Burger, M.; Dessel, E.L. van; Bartolini, C.; Guarnieri, A.; Piccioni, A.; Kurt, V.G.; Sheffer, E.K. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

In this paper we emphasize the study of the physics and dynamics of the mass transfer at periastron and subsequent X-ray flaring, which is a typical problem of the X-ray/Be binary system class.

37435 (ESA-SP–281, pp. 145-148) **IUE and optical observations of X-ray sources in the LMC.** Bianchi, L. (Osservatorio Astronomico, Turin (IT)); Pakull, M. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The optical counterparts of LMC X-6 (star Wo564) and of LHG-8 (HV5542) were observed with IUE and with several optical instruments at ESO. We present here the analysis of the UV spectral features and continuum flux, from which the values of the effective temperature and bolometric luminosity of the stars are derived. We also analyze a number of UV and optical observations of the source LHG-83, obtained over the past three years.

37436 (ESA-SP–281, pp. 155-158) **1981 outburst of the old nova GK persei.** Panek, R.J. (Wellesley Coll., MA (US)); Raymond, J.C.; Hartmann, L.W.; Swank, J.H.; Wu, C.C.; Holm, A.V. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

GK Per was observed in 1981 with the IUE, during its rise, maximum, and subsequent return to minimum. In outburst, GK Per is luminous but much redder than dwarf novae or standard model accretion disks. The observed spectrum can be explained qualitatively with the Ghosh and Lamb model for the interaction of an accretion disk with the magnetic field of the accreting white dwarf. N V and He II are enhanced relative to other emission lines during outburst. This can be understood with photoionization by very soft X-rays having a luminosity comparable to that of the hard X-rays.

37437 (ESA-SP–281, pp. 163-166) **Observations and simulations of Nova Vul 1984 2: a Nova with ejecta rich in oxygen, neon, and magnesium.** Starrfield, S. (Arizona State Univ., Tempe (US). Dept. of Physics); Los Alamos National Lab., NM; Sonneborn, G.; Stryker, L.L.; Sparks, W.M.; Ferland, G.; Wagner, R.M.; Gallagher, J.S.; Wade, R.; Williams, R.E. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Nova Vul 1984 has been observed with the IUE Satellite from December 1984 through November 1987 and we expect to be able to observe it with the IUE Satellite for at least another two years. These spectra are characterized by strong lines from Mg, Ne, C, Si, O, N, and other elements. Data obtained in the ultraviolet, infrared, and optical show that this nova is ejecting material rich in oxygen, neon, and magnesium.

37438 (FNAL/C–89/112-A) **The cosmological constant problem.** Dolgov, A.D. Fermi National Accelerator Lab., Batavia, IL (USA). May 1989. 14p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-8903132–2: 24. Rencontres de Moriond: electroweak interactions and unified theories, Les Arcs, France, 5-12 Mar 1989). Order Number DE89013150/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A review of the cosmological term problem is presented. Baby universe model and the compensating field model are discussed. The importance of more accurate data on the Hubble constant and the Universe age is stressed. 18 refs.

37439 (LAL–88-41) **Introduction to gravity and cosmology.** Jauneau, L. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Sep 1988. 91p. (CONF-8809359–: International school of elementary particle physics, Duilovo-Split, Yugoslavia, 18 Sep - 2 oct 1988). Order Number DE89781520/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Relativity principles, equivalence principles, and the general covariance principle are introduced. Curved space analysis via tensor calculus and absolute differential calculus is outlined. Einstein's equations are presented. The Schwarzschild solution; tests of general relativity; and black holes are discussed. Application of general relativity to cosmology is considered. The Standard Model of cosmology and its extensions are reviewed.

37440 (LBL–26210) **Cosmic relics from the big bang.** Hall, L.J. Lawrence Berkeley Lab., CA (USA). Dec 1988. 19p. Sponsored

by DOE Energy Research. DOE Contract AC03-76SF00098. (UCB-PTH-88/26;CONF-880747-7: 16. annual SLAC summer institute on particles physics, Stanford, CA, USA, 18-29 Jul 1988). Order Number DE89013268/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A brief introduction to the big bang picture of the early universe is given. Dark matter is discussed; particularly its implications for elementary particle physics. A classification scheme for dark matter relics is given. 21 refs., 11 figs., 1 tab.

37441 (LBL–27233) **Spectral measurements of the cosmic microwave background.** Kogut, A.J. Lawrence Berkeley Lab., CA (USA). Apr 1989. 195p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. AST-84O6187;DPP-8716548. Order Number DE89014895/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

Three experiments have measured the intensity of the Cosmic Microwave Background (CMB) at wavelengths 4.0, 3.0, and 0.21 cm. The measurement at 4.0 cm used a direct-gain total-power radiometer to measure the difference in power between the zenith sky and a large cryogenic reference target. Foreground signals are measured with the same instrument and subtracted from the zenith signal, leaving the CMB as the residual. The reference target consists of a large open-mouth cryostat with a microwave absorber submerged in liquid helium; thin windows block the radiative heat load and prevent condensation atmospheric gases within the cryostat. The thermodynamic temperature of the CMB at 4.0 cm is 2.59 $\pm$ 0.07 K. The measurement at 3.0 cm used a superheterodyne Dicke-switched radiometer with a similar reference target to measure the zenith sky temperature. A rotating mirror allowed one of the antenna beams to be redirected to a series of zenith angles, permitting automated atmospheric measurements without moving the radiometer. A weighted average of 5 years of data provided the thermodynamic temperature of the CMB at 3.0 cm of 2.62 $\pm$ 0.06 K. The measurement at 0.21 cm used Very Large Array observations of interstellar ortho-formaldehyde to determine the CMB intensity in molecular clouds toward the giant HII region W51A (G49.5-0.4). Solutions of the radiative transfer problem in the context of a large velocity gradient model provided estimates of the CMB temperature within the foreground clouds. Collisional excitation from neutral hydrogen molecules within the clouds limited the precision of the result. The thermodynamic temperature of the CMB at 0.21 cm is 3.2 $\pm$ 0.9 K. 72 refs., 27 figs., 38 tabs.

37442 (RRK–88-40) **Gravitational lensing and finite beam-width effect on cosmic microwave anisotropies.** Sasaki, Misao; Tomita, Kenji. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Dec 1988. 11p. Order Number DE89790890/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The temperature anisotropies of cosmic microwave background under the influence of gravitational lenses are investigated taking into account the smearing effect due to a finite beam-width of an observational apparatus. In contrast to the zero beam-width case, in which the anisotropies on small angular scales are enhanced by the lens effect, a finite beam-width may smear out the so-enhanced anisotropies and hence can lead to a suppression of the small angular anisotropies. Using a simple model of the temperature fluctuation spectrum at the decoupling epoch, this possibility is examined over various model parameters. It is found that a strong suppression of the anisotropies occurs only in the case when the beam-width is comparable or greater than the intrinsic coherence angle θ_c of the temperature anisotropy and the characteristic deflection angle by gravitational lenses is much larger than θ_c.

37443 (RRK–89-3) **Stochastic dynamics of an inflationary model and initial distribution of universes.** Nambu, Yasusada. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Jan 1989. 32p. Order Number DE89790892/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

We investigate the stationary solution of the modified Fokker-Planck equation which governs the global dynamics of the inflation. Contrary to the original FP equation which is for a Hubble horizon size region, we found that the normalizable stationary solution can exist for modified Fokker-Planck equation which is for many Hubble horizon size regions. For a chaotic inflationary model with the potential λpsi^{2n}, we get initial distribution of classical universes using this solution, and discussed the physical meaning of it. Especially for n = 2, this distribution obeys power-law and classical universes which created from the Planck energy region make the fractal structure. Other cases n not = 2, creation of large classical universes are strongly suppressed.

37444 (RRK–89-4) **On a quantized scalar field in some Kantowski-Sachs' universes.** Nariai, Hidekazu. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Jan 1989. 10p. Order Number DE89790893/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

As a sequel to the previous paper on a quantized scalar field in some isotropic universes, a canonically quantized scalar field in several Kantowski-Sachs' universes is searched for. Various bi-scalar propagators for the quantized scalar field are introduced. Especially, the 4-dimensional commutation function (which is uniquely defined) in the Groen universe satisfying the vacuum Einstein equations $R_{\mu\nu} = \Lambda g_{\mu\nu}$ (A: the cosmological constant) is outlined.

37445 (RRK–89-7) **Wormhole instanton solution in the Einstein-Yang-Mills system.** Hosoya, Akio; Ogura, Waichi. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Jan 1989. 10p. (INS–733). Order Number DE89790895/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

A spherical symmetric classical solution of the Einstein and the SU(2) Yang-Mills equations is found in the four dimensional Euclidean space-time with the cosmological constant. The isospinor fermion has zero modes. Their cosmological implications are also discussed with an emphasis on the fact that wormhole instantons in general can be found not only in the sub-Planck physics but also in almost all the stages in lower energy physics.

37446 Millimeter wavelength observations of SS 433 and its environs. Band, D.L. (Lawrence Livermore National Laboratory, CA (USA)); Gordon, M.A. *Astrophysical Journal (USA)*, 338: 945-951 (Mar 1989).

Millimeter-wave continuum and CO spectral line observations of SS 433 and the IRAS-detected infrared objects in the vicinity of SS 433 are reported. The 90 GHz flux from SS 433 was 0.087 + or - 0.037 Jy, consistent with an extrapolation of the lower frequency radio power-law spectrum. A 203 GHz upper limit for SS 433 is determined. Upper limits only were derived for two of the infrared objects at 90 and 203 GHz. The (C-12)O spectral lines from four of the infrared objects to the west of SS 433 were detected in the same velocity range as the western optical filaments and the nearby H II region S74. The masses and H2 column densities derived from the (C-12)O and (C-13)O lines are consistent with dark molecular clouds. It is suggested that the infrared sources and S74 are part of a gas complex in front of SS 433 and W50. 36 references.

6402 Atmospheric Physics

37447 (AD-A–204693/6/XAB) **Snapshots of high-latitude electrodynamics using Viking and DMSP f7 observations.** Marklund, G.T.; Blomberg, L.G.; Stasiewicz, K.; Murphree, J.S.; Pottelette, R. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 1 Dec 1988. 16p. (AFGL-TR–89-0040). Available from NTIS, PC A03/MF A01.

Pub. in Jnl. of Geophysical Research, Vol. 93, No. A12, 14,479-14,492(1 Dec 1988).

Simultaneous observations by the Viking and the DMSP F7 satellites were used as input to a new method to obtain snapshot pictures of the auroral electrodynamics. In particular, an instantaneous global equipotential (or convection) pattern is calculated from distributions of field-aligned current and conductivity which are qualitatively consistent with the Viking auroral imager data and quantitatively consistent with magnetic field and particle data from the two satellites. This convection pattern, which is of the normal two-cell type, with a weak dusk cell and a strong, elongated crescent-shaped dawn cell (consistent with positive interplanetary magnetic field By), agrees well with the Viking electric-field data. The model and the observed potential profiles agree nicely along

the entire Viking orbit except for two intervals above acceleration regions where deviations are to be expected (due to parallel electric fields). These regions are characterized by U-shaped potential minima, upward field-aligned currents, upgoing ion beams, and relatively intense auroral kilometric radiation. Thus, the model results are consistent with the Viking observations not only on a global scale but also on the scale of the auroral acceleration regions. The corresponding convection in the magnetosphere is obtained from a simple projection to the equatorial plane of the deduced two-cell convection pattern. From this the location of the plasmapause is inferred.

37448 (AD-A-204699/3/XAB) **Global density specification in the lower thermosphere. Final report, 15 June 1985-17 June 1988.** Forbes, J.M. Boston Univ., MA (USA). 31 Aug 1988. 20p. Available from NTIS, PC A03/MF A01.

Energetic inputs were derived from various satellite measurements and ground-based sensors for input into the Thermosphere General Circulation Model (TGCM) simulation of the magnetic storm occurring on March 22, 1979. The simulation was compared with thermospheric densities and winds measured from an Air Force satellite, and incoherent-scatter-radar measurements of thermospheric temperatures. An evaluation of the overall performance of the model and various physical processes accounting for discrepancies with data was performed. A FORTRAN program was developed to perform wave/spectral analyses of density data from the Satellite Electrostatic Triaxial Accelerometer (SETA) instrument using the maximum entropy method. The program was applied to a subset of available SETA data to illustrate typical wave characteristics for geomagnetically quiet and disturbed conditions. A climatological summary was performed of the average magnetic activity dependences of high-latitude thermospheric winds and densities below 200 km using SETA data from the March/April, 1979, period.

37449 (AD-A-204855/1/XAB) **Investigation of the production of nitric oxide by soft solar x rays in the e-region of the ionosphere. Master's thesis.** Dumas, R.A. Naval Postgraduate School, Monterey, CA (USA). Dec 1988. 65p. Available from NTIS, PC A04/MF A01.

The production of nitric oxide by soft solar X rays in the E region of the ionosphere is investigated. An empirical expression for the variation in X ray flux as a function of F10.7 is determined. This expression is incorporated into a one-dimensional diffusive photochemical model to compute nitric oxide densities. The results of these calculations are compared with NO observations from the Solar Mesosphere Explorer satellite. Variations of X-ray flux by a factor of 30 over the solar cycle can explain the observed variation in nitric oxide densities.

37450 (AD-A-204902/1/XAB) **Path-integral formulation of ion heating.** Crew, G.B.; Chang, T. Massachusetts Inst. of Tech., Cambridge, MA (USA). Center for Space Research. Nov 1986. 16p. Available from NTIS, PC A03/MF A01.

Pub. in Physics of Fluid, Vol. 31, No. 11, 3425-3439(Nov 1988).

A description of the generation and evolution of ionospheric oxygen-ion conic distributions by electromagnetic ion-cyclotron-resonance heating is formulated in terms of a path integral. All of the relevant physics is contained in this path integral, which may be used to calculate measurable properties of the conic distribution. Although the presentation is applied to this specific ionospheric context, the treatment may be generalized to treat other diffusion problems of interest.

37451 (AD-A-205145/6/XAB) **Theoretical modeling of plasma waves in the magnetosphere. Final report, 1 October 1982-30 September 1988.** Patel, V.L. Denver Univ., CO (USA). Dept. of Physics. Oct 1988. 7p. Available from NTIS, PC A02/MF A01.

Theoretical studies of plasma waves play an important role in the understanding of characteristics of the problems of communications in the ionized environments of the earth. This project devoted efforts in the study of low-frequency waves in the ionosphere and the magnetosphere. The aim was to include all recent attributes of the magnetospheric plasma, e.g., inhomogeneity, various ion species, and finite-beta effects in the theoretical modes. All of these features of the plasma medium affect the communication in various frequency ranges.

37452 (AD-A-205193/6/XAB) **Electron-density profiles and plasma-drift measurements with digital ionosondes. Technical report, July 1987-June 1988.** Reinisch, B.W.; Buchau, J.; Gamache, R.R.; Bibl, K.; Sales, G.S. Lowell Univ., MA (USA). Center for Atmospheric Research. Sep 1988. 31p. (ULRF-442/CAR). Available from NTIS, PC A03/MF A01.

Knowledge of the three-dimensional electron-density distribution and the plasma drift in the earth's ionosphere is needed for the radio communication engineer and the geophysicist. The combination of global models, e.g. the International Reference Ionosphere (IRI), modern digital ionosondes, and relatively powerful micro-computers provide the capabilities to overcome the limitations that have heretofore prevented real-time ionospheric specification and improved forecasting techniques. The developing network of digital ionosondes provides an improved ionogram data set. The cumbersome evaluation of electron density profiles (EDP), from the ionograms, has been eased with automatic ionogram scaling and related microcomputer-based algorithms for calculating EDPs. The purpose of this report is to summarize the evolving network of digital ionosondes based on the Digisonde 256 technology and to present techniques that have been developed for calculating electron-density profiles and determining the drift velocities. In addition, examples are presented to illustrate related data summaries that can be developed and tailored to the needs of the communication or radar-system manager and to the needs of the geophysicist involved in basic and applied research in solar-terrestrial physics.

37453 (IRF-194) **Investigations of auroral dynamics: techniques and results.** Steen, Aa. Swedish Inst. of Space Physics, Kiruna (Sweden). Oct 1988. 30p. Order Number DE89617988/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This study is an experimental investigation of the dynamics of the aurora, describing both the systems developed for the optical measurements and the results obtained. It is found that during a auroral arc deformation, a fold travelling eastward along the arc is associated with an enhanced F-region ion temperature of 2700 K, measured by EISCAT, indicative of enhanced ionspheric electric fields. It is shown that for an auroral break-up, the large-scale westward travelling surge (WTS) is the last developed spiral in a sequence of spiral formations. It is proposed that the Kelvin-Helmholtz instability is the responsible process. In another event it is shown that large-amplitude long-lasting pulsations, observed both in ground-based magnetic field and photometer recordings, correspond to strong modulations of the particle intensity at the equatorial orbit (6.6 Re). In this event a gradual transition occurs between pulses classified as Ps6/auroral torches toward pulses with characteristics of substorms. The observations are explained by the Kelvin-Helmholtz instability in a magnetospheric boundary layer. The meridional neutral wind, at about 240 km altitude, is found to be reduced prior to or at the onset of auroral activity. These findings are suggestive of large-scale reconfigurations of the ionspheric electric fields prior to auroral onsets. A new real time triangulation technique developed to determine the altitude of auroral arcs is presented, and an alternative method to analyze incoherent scatter data is discussed. (With 46 refs.)

37454 (IRF-196) **Scientific results from the Swedish Viking satellite: A 1988 status report.** Hultqvist, B. Swedish Inst. of Space Physics, Kiruna (Sweden). May 1988. 36p. Order Number DE89617989/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The contributions of the Viking mission to space physics up to the early spring of 1988 are summarized in the following areas: global distribution of magnetosphere-ionosphere interaction, auroral morphology and substorm dynamics, heating and expulsion of ionspheric plasma into the magnetosphere, field-aligned acceleration into the ionosphere and wave generation. (With 64 refs.)(L.E.).

37455 (LA-UR-89-1592) **Parallel electric fields in a simulation of magnetotail reconnection and plasmoid evolution.** Hesse, M.; Birn, J. Los Alamos National Lab., NM (USA). 1989. 25p. Sponsored by DOE/ER;NASA. DOE Contract W-7405-ENG-36. (CONF-8903131-1: Chapman conference on the physics of magnetic flux ropes, Hamilton, Bermuda, 27-31 Mar 1989). Order Number DE89012622/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We investigate properties of the electric field component parallel to the magnetic field ($E_{||}$) in a three-dimensional MHD simulation of plasmoid formation and evolution in the magnetotail in the presence of a net dawn-dusk magnetic field component. We emphasize particularly the spatial location of $E_{||}$, the concept of a diffusion zone and the role of $E_{||}$ in accelerating electrons. We find a localization of the region of enhanced $E_{||}$ in all space directions with a strong concentration in the z direction. We identify this region as the diffusion zone, which plays a crucial role in reconnection theory through the local break-down of magnetic flux conservation. The presence of B_y implies a north-south asymmetry of the injection of accelerated particles into the near-earth region, if the net B_y field is strong enough to force particles to follow field lines through the diffusion region. We estimate that for a typical net B_y field this should affect the injection of electrons into the near-earth dawn region, so that precipitation into the northern (southern) hemisphere should dominate for duskward (dawnward) net B_y. In addition, we observe a spatial clottiness of the expected injection of adiabatic particles which could be related to the appearance bright spots in auroras. 12 refs., 9 figs.

37456 (LA-UR–89-1595) **Magnetopause structure and dynamics: Issues for GEM [geospace environment modeling].** Elphic, R.C. Los Alamos National Lab., NM (USA). 1989. 18p. Sponsored by DOE/DP;NASA. DOE Contract W-7405-ENG-36. (CONF-8902115–1: 1. geospace environment modeling (GEM) workshop, San Diego, California, USA, 19-21 Feb 1989). Order Number DE89012620/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Recent multi-spacecraft observations of the magnetopause have allowed us to establish its structure and dynamical behavior. The magnetopause current sheet is thicker than expected, often ten magnetosheath ion gyroradii or more. One very important result has been the confirmation of magnetic reconnection in both its quasi-steady and transient forms. A boundary layer of magnetosheath-like plasma is often, but not always, observed earthward of the magnetopause current layer. There is considerable small-scale magnetic structure within the current layer, suggesting the presence of filamentary currents much smaller than an ion gyroradius. Such micro-structure may be important in particle diffusion and, hence, reconnection. There are many outstanding questions, among them: How does the low latitude boundary layer form? Why is the magnetopause current layer so thick? What is the detailed structure and topology of FTEs? How are quasi-steady and transient reconnection related? The GEM program may help us address these issues. 18 refs., 9 figs.

37457 (LA-UR–89-1848) **Caviton dynamics in strong Langmuir turbulence.** DuBois, D.; Rose, H.A.; Russell, D. Los Alamos National Lab., NM (USA). 1989. 62p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8905156–1: International Centre for Theoretical Physics conference, Trieste, Italy, 22-26 May 1989). Order Number DE89012635/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Recent studies based on long time computer simulations of Langmuir turbulence as described by Zakharov's model will be reviewed. These show that for strong to moderate ion sound samping the turbulent energy is dominantly in nonlinear "caviton" excitations which are localized in space and time. A local caviton model will be presented which accounts for the nucleation-collapse-burnout cycles of individual cavitons as well as their space-time correlations. This model is in detailed agreement with many features of the electron density fluctuation spectra in the ionosphere modified by powerful hf waves as measured by incoherent scatter radar. Recently such observations have verified a prediction of the theory that "free" Langmuir waves are emitted in the caviton collapse process. These observations and theoretical considerations also strongly imply that cavitons in the heated ionosphere, under certain conditions, evolve to states in which they are ordered in space and time. The sensitivity of the high frequency Langmuir field dynamics to the low frequency ion density fluctuations and the related caviton nucleation process will be discussed. 40 refs., 19 figs.

37458 (PPPL–2628) **On field line resonances of hydromagnetic Alfven waves in dipole magnetic field.** Chen, Liu; Cowley, S.C. Princeton Univ., NJ (USA). Plasma Physics Lab. Jul 1989. 11p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE89014603/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Using the dipole magnetic field model, we have developed the theory of field line resonances of hydromagnetic Alfven waves in general magnetic field geometries. In this model, the Alfven speed thus varies both perpendicular and parallel to the magnetic field. Specifically, it is found that field line resonances do persist in the dipole model. The corresponding singular solutions near the resonant field lines as well as the natural definition of standing shear Alfven eigenfunctions have also been systematically derived. 11 refs.

37459 **Magnetic field-aligned plasma expansion in critical ionization velocity space experiments.** Singh, N. (Univ. of Alabama at Huntsville, Huntsville, AL (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA)*, 17(2): 116-123 (Apr 1989).

Motivated by the recent Critical Ionization Velocity (CIV) experiments in space, the temporal evolution of a plasma cloud released in an ambient plasma is studied. Time-dependent Vlasov equations for both electrons and ions, along with the Poisson equation for the self-consistent electric field parallel to the ambient magnetic field, are solved. The initial cloud is assumed to consist of cold, warm, and hot electrons with temperatures $T_c \simeq 0.2$ eV, $T_w \simeq 2$ eV, and $T_h \simeq 10$ eV, respectively. It is found that the minor hot electrons escape the cloud, and their velocity distribution function shows the typical time-of-flight dispersion feature - that is, the larger the distance from the cloud, the larger is the average drift velocity of the escaping electrons. The major warm electrons expand along the magnetic field line with the corresponding ion-acoustic speed. The combined effect of the escaping hot electrons and the expanding warm ones sets up an electric potential structure which accelerates the ambient electrons into the cloud. Thus, the energy loss due to the electron escape is partly replenished. The electric field distribution in the potential structure depends on the stage of the evolution; before the rarefaction waves propagating from the edges of the cloud reach its center, the electric fields point into the cloud. After this stage the cloud divides into two subclouds, with each having their own bipolar electric fields. Effects of collisions on the evolution of plasma clouds are also discussed. The relevance of the results seen from the calculations are discussed in the context of recent space experiments on CIV.

6403 Atomic, Molecular, and Chemical Physics

Refer also to citation(s) 36735, 36846, 37639, 37738, 37776

37460 (AD-A–201236/7/XAB) **Resonant charge-exchange studies with hyperthermal-energy ion beams: development of multi-detection capabilities and a data acquisition system. Final report, 15 November 1986-14 May 1988.** Cooper, B.H. Cornell Univ., Ithaca, NY (USA). Lab. of Atomic and Solid State Physics. 29 Aug 1988. 12p. Available from NTIS, PC A03/MF A01.

The overall research program described in this report is to investigate the interactions of hyperthermal (10-100 eV) and keV ions with clean and adsorbate-covered metal surfaces. Particular emphasis is placed on the study of ion-surface charge-exchange processes. Progress in instrumentation includes: completion of the general apparatus, the successful production of low phase-space alkali and noble-gas beams ranging in energy from about 10 eV to several keV, completion of two hemispherical analyzers for detecting scattered ions (one with high-resolution capabilities, the other for large angle scattering studies), design details of the position-sensitive pulse-counting detectors for multi-energy detection, and the configuration of a Macintosh II-based data-acquisition system. Scientific progress includes: measurements of 50-eV to 4-keV alkali scattering from clean and cesiated Cu(110), simulations using Hartree-Fock pair potentials that give good agreement with the 100- to 400-eV Na(+) scattering from Cu(110), trajectory analysis to identify peaks in the Na(+) energy spectra, measurements of charge-transfer probabilities for alkalis scattered from (Cu(110)) with low coverages (<1/10 monolayer) of Cs adsorbates, and ongoing development of a model that includes both local and collective effects of the Cs overlayers in determining charge transfer probabilities.

37461 (AD-A-204750/4/XAB) **Physics of spin-polarized atomic vapors. Final report, 1 October 1986-30 April 1988.** Happer, W. Princeton Univ., NJ (USA). 26 May 1988. 4p. Available from NTIS, PC A02/MF A01.

Efforts were focused on the study of spin-polarized atoms, nuclei and electrons during the period covered by this report. Although this work is 6.1 basic research, it has applications to a number of important Air Force problems. For example, the atomic clocks used on the GPS satellite system operate with optically pumped Rb absorption cells, very similar to the ones being investigated in this laboratory. A number of the scientists and engineers working on atomic clocks used by Air Force satellite systems were trained with the support of this grant. The author has participated in recent Air Force advisory panels to review concepts for high-energy-density fuels based on spin polarized atoms and molecules. The insights gained from research sponsored by this grant have been very useful in evaluating these ideas. Recent work has focused on two main areas, the investigation of quadrupolar interactions between spin-polarized noble-gas nuclei and surfaces and the quantitative investigation of how magnetic-field inhomgeneities cause spin relaxation.

37462 (AD-A-205015/1/XAB) **Multiple ionization of xenon by proton impact.** Manson, S.T.; DuBois, R.D. Georgia State Univ., Atlanta, GA (USA). Dept. of Physics. Dec 1987. 5p. Available from NTIS, PC A02/MF A01.

Pub. in Jnl. de Physique, confC9 suppl12 Vol. 48, C9-263-C9-266(Dec 1987).

An experimental and theoretical study of multiple ionization of xenon for 0.2- to 2.0-MeV proton impact was made. Absolute cross sections for producing xenon ions with charges from +1 to +3 were measured, and calculations of subshell cross sections were performed. Experiment and theory are consistent and indicate that multiple ionization of xenon by fast protons occurs via inner-shell ionization. This is in contrast to the lighter noble gases where direct multiple outer shell ionization can be predominant.

37463 (AD-A-205197/7/XAB) **Studies of collisional and nonlinear radiative processes for development of coherent uv and xuv sources. Final report, 30 September 1985-29 September 1988.** Rhodes, C.K.; Boyer, K.; Luk, T.S. Illinois Univ., Chicago, IL (USA). Lab. for Atomic Molecular and Radiation Physics. 17 Nov 1988. 81p. Available from NTIS, PC A05/MF A01.

A laboratory means for generation of ultrahigh-energy-density states of matter, corresponding approximately to 0.1 - 1.0 W/atom at solid density, is currently under development. This enables the production, in a convenient laboratory environment, of energy densities comparable to those occurring in the thermonuclear environments and stellar interiors. The method being developed involves a unique combination of three basic elements. They are (a) a new extremely high-peak-power ultraviolet-laser technology (femtosecond rare gas halogen systems), (b) energy deposition stemming from high-order multiphoton processes, and (c) a mode of channeled propagation that arises in the strong-field regime. The compatibility of these three independent considerations is a key and unique feature of the approach. The use of this technology will permit the study of new realms of atomic phenomena.

37464 (CONF-890618-2) **Multiphoton ionization of $(Xe)_n$ and $(NO)_n$ clusters using a picosecond laser.** Smith, D.B.; Miller, J.C. Oak Ridge National Lab., TN (USA). 1989. 4p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 9. international conference on laser spectroscopy; Bretton Woods, New Hampshire, USA; 18-23 Jun 1989. Order Number DE89014098/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In an effort to extend the application of multiphoton ionization (MPI) spectroscopy to the study of weakly bound systems, we have begun a systematic investigation of picosecond MPI in van der Waals molecules and clusters. To our knowledge no previous picosecond MPI studies of weakly bound systems have been reported. We present here results of picosecond MPI of Xe_n(n = 1-20) and $(NO)_n$(n = 1-4) clusters. Previous MPI studies using nanosecond lasers have not detected the NO cluster series, presumably because of fast dissociation channels. The use of high peak-power allows resonant and non-resonant photon absorption to the ionization limit to compete effectively with fast dissociative processes. 10 refs., 2 figs.

37465 (CONF-890652-1) **Saturation behavior of parametric four-wave mixing due to two-photon interference effect.** Garrett, W.R.; Hart, R.C.; Moore, M.A.; Payne, M.G.; Wunderlich, R.K. Oak Ridge National Lab., TN (USA). Jun 1989. 5p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 6. Rochester conference on coherence and quantum optics; Rochester, NY, USA; 26-28 Jun 1989. Order Number DE89014076/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Strong pumping of "extended" alkali metal vapors near two-photon resonances produces copious stimulated emissions by amplified spontaneous emission or stimulated electronic hyper-Raman scattering, and by phase matched parametric four-wave mixing. The new electromagnetic fields that are generated within the near-resonant nonlinear medium can strongly influence the total atomic response through processes including interferences, level shifting, and population transfer mechanisms. The internally generated fields can, e.g., suppress transition probabilities for processes involving excitations (SEHRS and two-photon excitations) and produce gain saturation for PFWM processes. This paper discusses the saturation behavior. 8 refs., 2 figs.

37466 (CONF-890703-10) **A lithium liquid metal ion source suitable for high voltage terminal applications.** Read, P.M.; Maskrey, J.T.; Alton, G.D. Oak Ridge National Lab., TN (USA). 1989. 12p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From International conference on ion sources; Berkeley, CA, USA; 9-15 Jul 1989. Order Number DE89014096/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Liquid metal ion sources offer potential improvement in lateral resolution over conventionally used gaseous sources for MeV microprobe applications because of their intrinsic brightnesses. The use of a Li liquid metal ion source is particularly attractive because of the increased sensitivity of lithium for detecting hydrogen (hydrogen profiling) and for detecting near surface contaminants through high-resolution Rutherford backscattering spectrometry. However, the technical difficulty of occasional sparking between the needle and extraction electrode requires that the needle of the Li liquid metal ion source be rewetted before reignition can be effected; this problem makes Li liquid metal ion sources of the usual design risky for operation in the insulated high-voltage terminals of accelerators used in such applications. We have designed a reliable, long-lived, Li liquid-metal ion source which has provisions for overcoming this limitation. The design features and performance characteristics of the source are described in this report. 9 refs., 4 figs.

37467 (CONF-890703-12) **A high-intensity plasma-sputter heavy negative ion source.** Alton, G.D.; Mori, Y.; Takagi, A.; Ueno, A.; Fukumoto, S. Oak Ridge National Lab., TN (USA). 1989. 31p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From International conference on ion sources; Berkeley, CA, USA; 9-15 Jul 1989. Order Number DE89014875/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A multicusp magnetic field plasma surface ion source, normally used for H^- ion beam formation, has been modified for the generation of high-intensity, pulsed, heavy negative ion beams suitable for a variety of uses. To date, the source has been utilized to produce mA intensity pulsed beams of more than 24 species. A brief description of the source, and basic pulsed-mode operational data, (e.g., intensity versus cesium oven temperature, sputter probe voltage, and discharge pressure), are given. In addition, illustrative examples of intensity versus time and the mass distributions of ion beams extracted from a number of samples along with emittance data, are also presented. Preliminary results obtained during dc operation of the source under low discharge power conditions suggest that sources of this type may also be used to produce high-intensity (mA) dc beams. The results of these investigations are given, as well, and the technical issues that must be addressed for this mode of operation are discussed. 15 refs., 10 figs., 2 tabs.

37468 (IAEA-R–4434-F) **Implementation of computer programmes for fitting of positron annihilation spectra on "personal computers". Final report for the period 1 May 1986 - 14 June 1988.** Eldrup, M. Risoe National Lab., Roskilde (Denmark); International Atomic Energy Agency, Vienna (Austria). Feb 1989. 9p. Order Number DE89618367/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A computer programme package was developed for analysis of positron annihilation experimental results. The software is designed for computers running under MS-DOS operating system written in FORTRAN-77 and operates on any personal computer. Three separate modes of spectra evaluation are available. (1) POSITRONFIT is applied to obtain lifetimes and intensities from a lifetime spectrum; (2) RESOLUTION enables the determination of resolution function from measured lifetime spectrum; (3) ACARFIT is intended for fitting of angular correlation curves. For each of these programmes, a separate interactive programme was developed permitting a user-friendly editing of input data. The graphical features permit the display of measured and fitted spectra. The printing and plotting facilities are available.

37469 (INIS-mf–11440, pp. 144-145) **Electron impact fragmentation study of compounds from colour photosensible materials.** Culea, M (Institutul de Tehnologie Izotopica si Moleculara, Cluj-Napoca (Romania)); Palibroda, M.; Moldovan, Z.; Fodor, E.; Vegh, P. Central Inst. of Physics, Bucharest (Romania). 1988. (In Romanian). (CONF-8810372–: Advances in physics, Constanta, Romania, 6-8 Oct 1988). In *Advances in Physics.* Order Number DE89012158/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

A fragmentation study of some compounds from colour photosensible materials ,using metastable ion detection was performed. (authors).

37470 (INIS-SU–94/A, pp. 40-42) **Ionization of Rydberg energy levels of ions at low temperature.** Ragozin, E.N. AN SSSR, Moscow (USSR). Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics.* Order Number DE89012156/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Kratkie soobshcheniya po fizike.; no. 8.

The paper is aimed at finding the efficiency of radiation-collision ionization/recombination with Rydberg energy levels of ions in the wide range of density values both at high and low values of the electron temperature, as well as at studying dynamics of the processes given. The problem on evaluation of time distribution of populations at plasma constant parameters and initial δ-like level distribution of populations is solved. The mechanism of stage ionization of the Rydberg levels of ions in the dense plasma is established to be effective up to comparatively low temperatures, at which direct ionization by the p level is impossible. 4 refs.; 2 figs.

37471 (IPNO-DRE–87-33(7)) **Experiments on secondary ion emission with multicharged keV ion bombardement.** Della Negra, S.; Depauw, J.; Joret, H.; Le Beyec, Y.; Schweikert, E.A. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1987. 15-18p. (CONF-8709412–: Conference on ion formation from organic solids, Munster, DE, USA, 21-22 Sep 1987). Order Number DE89781426/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

An electron cyclotron resonance ion source was used to study the influence of the incident charge state of keV ions on secondary ion emission. The experiments were run with 18 keV Arn+ ($1 < n < 11$) beams produced by a minimafios source. Various types of targets were bombarded by the ion beam and the sputtered ionized species were identified by time of flight mass spectrometry. The experimental arrangement is detailed and preliminary results are indicated.

37472 (IPNO-DRE–88-17) **Dynamical aspects of violent collisions in Ar + Ag reactions at E/A = 27 MeV.** Rivet, M.F.; Borderie, B.; Jouan, D.; Gregoire, C.; Remaud, B. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1988. 6p. Order Number DE89789223/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

Intermediate-mass fragment studies were found to give an overview of the mechanisms involved in violent collisions between Ar and Ag at E/A = 27 MeV. A comparison is made with semi-classical calculations (Landau-Vlasov) which reproduce experimental observations well and sustain the persistence of dissipative processes at high incident relative velocity ($\sim$ 0.2c).

37473 (LA-UR–89-2164) **Study of atomic physics and population inversions with plasma focus.** Oona, H.; Hodgdon, M.L.; Rickel, D.G.; Freeman, B.L. Los Alamos National Lab., NM (USA). 1989. 7p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-36. (CONF-890710–14: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014282/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The plasma focus can be used to generate high temperature and high density plasmas. Neon-like plasmas have previously been studied in Z-pinches and laser produced plasmas as sources for XUV and x-ray lasers. The plasma focus provides a simple and inexpensive source for studying atomic physics of highly ionized atoms. A detailed understanding of atomic physics at high temperatures, densities, and megagauss magnetic fields is necessary for possible x-ray laser designs. Methods that are generally used for obtaining population inversions include collisional ionization of the inner shells of multi-electron atoms and ions, photoexcitation, and electron collisional excitation of ions, collisional combination of ions, and atom-ion resonant charge exchange. We will discuss some possible experiments to help understand the atomic physics under the above condition. Some ideas and calculations will be given to show the feasibility of doing atomic physics relating to x-ray lasers with a plasma focus. 13 refs., 2 figs.

37474 (ORNL/FTR–3275) **[Electron-ion cross beam experiments and ion-atom collisions, Louvain-la-Neuve, Belgium, Paris, France, Utrecht, the Netherlands, and Groeningen, the Netherlands, April 30–May 28, 1989]: Foreign trip report.** Havener, C.C. Oak Ridge National Lab., TN (USA). 12 Jun 1989. 17p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014728/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

To conduct a lecture series at the Universite Catholique de Louvain (UCL) on ion-atom collisions; to participate in an electron-ion crossed beam experiment at UCL; to meet with R. McCarroll and M. Gargaud at Universite Pierre et Marie Curie in order to compare their recent angular scattering calculations with measurements performed at ORNL on the ion-atom merged-beams apparatus; and to discuss ion-surface collisions with A. Niehaus of Rijksuniversiteit Utrecht and R. Morgenstern of Kernfysisch Versneller Instituut.

37475 (PNL-SA–16839) **Electrospray ionization and collision induced dissociation of large multiply charged ions.** Smith, R.D.; Udseth, H.R.; Loo, J.A.; Edmonds, C.G.; Barinaga, C.J. Pacific Northwest Lab., Richland, WA (USA). May 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-8905166–6: American Society for Mass Spectroscopy annual symposium, Miami Beach, Florida, USA, 22-26 May 1989). Order Number DE89014463/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

IONS/dissociation; IONIZATION; IONS; DISSOCIATION; SPECTRA; MOLECULES; CYTOCHROMES; COLLISIONS

37476 (SAND–89-1546C) **Pairing in CuO_2 driven by exchange interactions between carriers and localized Cu spins.** Stechel, E.B.; Jennison, D.R. Sandia National Labs., Albuquerque, NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890718–2: International conference on materials and mechanisms of superconductivity - high-temperature superconductors, Stanford, California, USA, 23-28 Jul 1989). Order Number DE89014488/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Calculations using a realistic multi-band extended Hubbard Hamiltonian, which correctly describes the Heisenberg excitation spectrum and superexchange energy of the insulating phase of CuO_2, show that the two largest energies relating to the carrier quasiparticle are the carrier bandwidth (>5 eV) and an exceptionally large ($\sim$3 eV times a density of states factor as in an RKKY interaction) effective exchange energy between a delocalized carrier hole and a localized Cu hole. The Cu holes are found to remain localized in the superconducting materials. Calculations using a

model pairing Hamiltonian show that this exchange energy induces (through partial spin-polarization of the Cu holes) an attraction between carriers. This attraction is strong enough to overcome a realistic Coulomb repulsion, hence leading to net attractive pairing. Triplet p-wave (or possibly singlet d-wave) pairing is implied. 7 refs.

37477 **Structure of Ag, Fe and Ge microclusters.** Montano, P.A. (Brooklyn Coll., NY (USA). Dept. of Physics); Zhao, J.; Ramanathan, M.; Shenoy, G.K.; Schulze, W. *Zeitschrift fuer Physik D: Atoms, Molecules and Clusters (F.R. Germany)*, 12(1-4): 103-105 (Jun 1989). (CONF-8807155–: 4. international symposium on small particles and inorganic clusters (ISSPIC-4), Aix-en-Province, France, 5-9 Jul 1988).

The structures of Ag, Fe and Ge microclusters were determined using EXAFS. The measurements were performed over a wide range of clusters sizes. The clusters were prepared using the gas aggregation technique and isolated in solid argon at 4.2 K. The measurements were performed at the National Synchrotron Light Source (NSLS) at beam line X-18B. A strong contraction of the interatomic distances was observed for Ag dimers and multimers. Silver clusters larger than 12 A mean diameter show a small contraction of the nn distance and a structure consistent with an fcc lattice. By contrast clusters smaller than 12 A show the presence of a small expansion and a strong reduction or absence of nnn in the EXAFS signal. This points towards a different crystallographic structure for Ag microclusters with diameter less than 12 A. In iron clusters we observe a gradual reduction of the nn distance as the cluster size decreases. The interatomic distance for iron dimers was determined to be 1.94 A, in good agreement with earlier measurements. The iron microclusters show a bcc structure down to a mean diameter of 9 A. Iron clusters with 9 A mean diameter show a structure inconsistent with a bcc lattice. The new structure is consistent with an fcc or hcp lattice. The measurements on Ge clusters show the presence of only nearest neighbors. There was clear evidence of temporal annealing as determined by variations in the near edge structure of the K-absorption edge. Absorption edge measurements were also performed for free Ge clusters travelling perpendicular to the direction of the synchrotron radiation beam. The measurements performed on the free clusters were consistent with those obtained for matrix isolated clusters.

6404 Fluid Physics

Refer also to citation(s) 36409, 36976, 36977, 36979, 37003, 37004, 37005, 37011, 37090

37478 (AD-A–204916/1/XAB) **CFD (computational fluid dynamics) research for mini-supercomputers: a Yale/UTRC program. Final report, 15 February 1987-14 October 1988.** Gropp, W.; Schultz, M. Yale Univ., New Haven, CT (USA). Dept. of Computer Science. 9 Jan 1989. 3p. Available from NTIS, PC A02/MF A01.

Research is directed at the application of modern computer technologies, with emphasis on emerging parallel computing techniques to the solution of fluid dynamic problems. CFD algorithms will be developed, implemented, analyzed, and benchmarked on several different architecture parallel computers.

37479 (AD-A–205096/1/XAB) **Computational fluid dynamics (CFD): element-by-element analysis for advanced computers. Final report, 1 April 1987-14 November 1988.** Carey, G.F. Texas Univ., Austin, TX (USA). Dept. of Aerospace Engineering and Engineering Mechanics. 14 Nov 1988. 5p. Available from NTIS, PC A02/MF A01.

This research focused on a class of domain-decomposition techniques for solution of problems in Computational Fluid Dynamics using advanced vector and parallel processors. Particularly considered are finite-element schemes and natural-element schemes and use of the natural-element partition of the domain to construct the decomposition algorithm. This then fits conveniently into the usual framework of finite-element calculations in which the primary loop is the independent calculation and assembly of element-matrix and vector contributions. By recasting the conjugate gradient method at this level, the system matrix need not be assembled and the intensive matrix-vector product step can be completely parallelized. These ideas constitute a major departure from traditional finite element schemes, and it is felt these efforts are a major new development that will strongly influence the technology.

37480 (LA-UR–89-2165) **Applications of the computer codes FLUX2D and PHI3D for the electromagnetic analysis of compressed magnetic field generators and power flow channels.** Hodgdon, M.L.; Oona, H.; Martinez, A.R.; Salon, S.; Wendling, P.; Krahenbuhl, L.; Nicolas, A.; Nicolas, L. Los Alamos National Lab., NM (USA). 1989. 8p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-36. (CONF-890710–13: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014281/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We present herein the results of three electromagnetic field problems for compressed magnetic field generators and their associated power flow channels. The first problem is the computation of the transient magnetic field in a two-dimensional model of helical generator during loading. The second problem is the three-dimensional eddy current patterns in a section of an armature beneath a bifurcation point of a helical winding. Our third problem is the calculation of the three-dimensional electrostatic fields in a region known as the post-hole convolute in which a rod connects the inner and outer walls of a system of three concentric cylinders through a hole in the middle cylinder. While analytic solutions exist for many electromagnetic field problems in cases of special and ideal geometries, the solutions of these and similar problems for the proper analysis and design of compressed magnetic field generators and their related hardware require computer simulations. In earlier studies, computer models have been proposed, several based on research oriented hydrocodes to which uncoupled or partially coupled Maxwell's equations solvers are added. Although the hydrocode models address the problem of moving, deformable conductors, they are not useful for electromagnetic analysis, nor can they be considered design tools. For our studies, we take advantage of the commercial, electromagnetic computer-aided design software packages FLUX2D nd PHI3D that were developed for motor manufacturers and utilities industries. 4 refs., 6 figs.

37481 (LA-UR–89-2187) **Instability of concave conductor surfaces at high magnetic pressure.** Parker, J.V.; Bowers, R.L.; Sheppard, M.G.; Weiss, D.L. Los Alamos National Lab., NM (USA). 1989. 18p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890710–3: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014277/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

At magnetic fields in excess of a few 100 T the energy dissipation in a conductor surface exceeds the characteristic vaporization energy and the metal conductor is disrupted. The threshold for this process, termed an "electrical explosion" by Demichev and Shneerson, is usually considered to be the field where the magnetic energy density $B_S^2/2\mu_0$ is equal to the volumetric evaporation energy density, Q_S. However, Q_S is not a uniquely defined quantity. Physically, "evaporation" is understood to mean a sufficient reduction in the average density of the conductor so that the resistivity rises to a high value and current flow is reduced. This reduction in density is opposed by the applied magnetic pressure and by the inertia of the material and thus Q_S is a function of both B_S and time. The definition of B_S is, therefore, an implicit one, $B_S = (2\mu Q_S[B_S Kt])^{1/2}$, and prediction of the "electrical explosion" requires a 1-D or 2-D MHD calculation using the complete mechanical and electrical equation of state (EOS) for the conductor material. This paper describes the results of the first experiment in this series and the analysis of the results obtained. The experiment was only partially successful in obtaining the conductor response data sought. During the experiment, an unexpectedly strong instability was observed that we believe may be an important cause of failure in high magnetic field apparatus. 4 refs., 9 figs.

37482 (SAND–88-3037C) **Stress in dilute suspensions.** Passman, S.L. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8904231–1: Constitutive relations and

models in continuum theories of multiphase flows, Minneapolis, Minnesota, USA, 4-7 Apr 1989). Order Number DE89012661/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Generally, two types of theory are used to describe the field equations for suspensions. The so-called "postulated" equations are based on the kinetic theory of mixtures, which logically ought to give reasonable equations for solutions. The basis for the use of such theory for suspensions is tenuous, though it at least gives a logical path for mathematical arguments. It has the disadvantage that it leads to a system of equations which is underdetermined, in a sense that can be made precise. On the other hand, the so-called "averaging" theory starts with a determined system, but the very process of averaging renders the resulting system underdetermined. I suggest yet a third type of theory. Here, the kinetic theory of gases is used to motivate continuum equations for the suspended particles. This entails an interpretation of the stress in the particles that is different from the usual one. Classical theory is used to describe the motion of the suspending medium. The result is a determined system for a dilute suspension. Extension of the theory to more concentrated systems is discussed. 14 refs.

37483 (SAND–89-0025C) **MHD calculations of anode plasmas.** Hussey, T.W.; Slutz, S.A.; Desjarlais, M.P. Sandia National Labs., Albuquerque, NM (USA). 1989. 15p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890665–23: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89014485/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We have performed a series of idealized MHD calculations of the response of an anode plasma layer to the rising magnetic field in an applied-B ion diode. The purpose of this study were to consider Joule heating of the plasma layer, which could pose potential problems for lithium ion diodes, and the leakage of flux behind the ion-emitting surface, which is related to impedance collapse. We find that, as induced JxB forces move the plasma toward the wall, the entrained, initial field is compressed until it just equals the rising external field. Achieving such equilibrium decreases both Joule heating and flux leakage into the plasma. For relatively thin (~1 mm) plasma layers at moderate densities (10^{16}–10^{17} cm^{-3}) we calculate that this equilibrium is achieved quite rapidly, leading to acceptably low levels of both flux penetration and Joule heating. 4 refs., 5 figs.

37484 (SAND–89-0046C) **Numerical solution of the Navier-Stokes equations for three-dimensional incompressible flows with open boundaries.** Schutt, J.A. Sandia National Labs., Albuquerque, NM (USA). 1989. 11p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890752–1: 6. international conference on numerical methods in laminar and turbulent flows, Swansea, UK, 11-15 Jul 1989). Order Number DE89009333/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Numerical modeling of the transient, nonisothermal, three-dimensional, incompressible Navier-Stokes equations imposes extreme demands on computational resources. For incompressible flow the Navier-Stokes equations form a coupled parabolic-elliptic set, with the elliptic nature caused by the incompressibility constraint. The elliptic nature of the incompressibility constraint forces some portion of the solution algorithm to be implicit, with the attendant computational costs. In addition, in regions of the computational domain where advective effects overwhelm viscous effects, the Navier-Stokes equations exhibit behavior which is similar to the hyperbolic nature of the Euler (inviscid) equations. In such regions many numerical methods which are suitable for parabolic equations will be dispersive, causing oscillations to appear in the solution. If accurate long-time solutions are required, dispersion must be avoided, as well as excessive numerical diffusion, which can result from attempts to control dispersion. The numerical algorithm presented here attempts to address these issues. 10 refs., 4 figs.

37485 (SAND–89-0780C) **Finite control volume modeling of laminar and turbulent flow of air in an enclosure.** Hogan, R.E.; Kettleborough, C.F. Sandia National Labs., Albuquerque, NM (USA). 1989. 11p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890752–2: 6. international conference on numerical methods in laminar and turbulent flows, Swansea, UK, 11-15 Jul 1989). Order Number DE89009334/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The finite control volume method (FCVM) was successfully used to calculate both laminar and turbulent buoyancy driven flow of air in a square enclosure for $Ra = 10^3$ to 10^8. For laminar flow, comparisons of the computed solution with both experimental data and other numerical solutions are in excellent agreement. Comparisons of selected velocities and average Nusselt numbers with a "benchmark" solution presented by deVahl Davis are consistently within 4%. For turbulent flow, the agreement with another numerical solution is generally good, considering the large difference in the number of nodes employed. The agreement with extrapolated experimental correlations for the average Nusselt number was acceptable. 20 refs., 4 figs., 2 tabs.

37486 (UCID–21696) **Linear theory of uncompensated thermal blooming in turbulence.** Chambers, D.H.; Karr, T.J.; Morris, J.R.; Cramer, P.G.; Viecelli, J.A.; Gautesen, A.K. Lawrence Livermore National Lab., CA (USA). 7 Feb 1989. 33p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE89014604/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A linearized theory of small perturbations in thermal blooming gives a surprisingly accurate description of the initial evolution of a plane wave propagating through an absorbing fluid medium. In the case of constant absorption and fluid velocity, a sinusoidal perturbation of the optical field grows quasi-exponentially at a rate determined by its Fresnel number and the accumulated OPD due to blooming. Perturbations with small transverse length scales grow more rapidly than those with large length scales. The evolution of the optical spectrum and Strehl ratio in the presence of optical turbulence is accurately described. The growth of the small scale fluctuations eventually leads to a drop in Strehl. More complicated cases with varying absorption and velocity profiles can be formally analyzed using a WKB approximation. Numerical simulations show growth suppression when the velocity varies along the optical path. These predictions from the linearized theory agree well with results from numerical simulations of the full nonlinear system and thus provides a standard for comparing different numerical codes. 12 refs., 9 figs.

37487 (UCRL–21155) **Nonlinear hydrodynamical innstabilities, transitions, and coherent features: Final report.** Marcus, P.S. Lawrence Livermore National Lab., CA (USA). Jun 1989. 3p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89014101/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The purpose of the research funded by this grant was to explore strongly nonlinear processes in hydrodynamical flows. To study the flows, large-scale numerical computations were required. Furthermore, each flow that was studied numerically was also examined in a laboratory experiment by another research group. Generally, the laboratory experiments were done after the numerical calculations were completed for the purpose of confirming the results and for exploring other parts of parameter space. Although all of the phenomena that we looked at were rich in nonlinear behavior, they were all bound together with a common thread: they exhibited temporally chaotic behavior while maintaining (or in some instances forming) coherent spatial structure. We summarize our main results in this paper.

37488 (UCRL–100997) **Dynamics of colloidal dispersions via lattice-gas models of an incompressible fluid.** Ladd, A.J.C.; Frenkel, D. Lawrence Livermore National Lab., CA (USA). May 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8902113–1: Cellular automata and modeling of complex physical systems, Les Houches, France, 21 Feb - 2 mar 1989). Order Number DE89013146/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Progress in applying lattice-gas models to the simulation of colloidal dispersions is described. A new set of collision rules for the four-dimensional face-centered-hypercubic lattice, which lead to an exactly isotropic viscosity and which can be implemented with a small table lookup, have been developed. However, they are only suitable for low Reynolds number flows. A new implementation of a

constant-velocity boundary condition for lattice-gas models is described. 8 refs.

37489 XUV laser amplification in recombining laser-produced plasmas. Kiehn, G.P. Thesis (Ph. D.). 156p. Univ. of Oxford, Oxford, England (1987). Available from UMI, Dissertation Information Service, 300 North Zeeb Road, Ann Arbor, MI 48106. BRD-81,570.

Direct measurements of laser amplification in recombining laser-produced plasmas were made in the XUV spectral region and are compared to computational simulations. Recombination pumping establishes population inversions of the Balmer-alpha transition in expanding plasma columns produced by the laser irradiation of thin-fiber targets. Time-resolved spectroscopic analysis of the axial radiation emission from the plasma clearly demonstrates the amplification of spontaneous emission in carbon and fluorine plasmas. The amplification of the Balmer-alpha transition was determined through several different diagnostic techniques, including the exponential growth of axial intensity with plasma length, studies of the temporal behavior of the line emission, and axial-to-transverse spectroscopic comparisons. The absolute calibration of the spectroscopic diagnostic allows the experimental results to be directly compared to numerical simulations obtained from a time dependent atomic physics package coupled to a one-dimensional hydrodynamic code.

6450 High Energy Physics

Refer also to citation(s) 37031, 37032

37490 Glueballs, hybrids, and exotic hadrons. AIP (Am. Inst. Phys.) Conf. Proc., No. 185. Chung, Suh-Urk (ed.). 729p. American Institute of Physics, New York, NY (1989). Sponsored by DOE/ER;OUS. From BNL workshop on glueballs, hybrids and exotic hadrons; Upton, New York, USA; 29 Aug - 1 sep 1988.

The Workshop on Glueballs, Hybrids, and Exotic Hadrons was held at BNL from August 29 through September 1, 1988. The emphasis was on bringing up-to-date the current status of hadron spectroscopy and on exploring experimental means of searching for states which lie beyond the realm of conventional quarkonia. General topics discussed are: gluonic states; exotic states; heavy flavors; conventional hadron; spectroscopy; lattice gauge; and future experiments, detectors and facilities.

37491 (DOE/ER/00881–T1) **Proposed activity - Budget for research in high energy physics: Technical progress report, January 1, 1990–December 31, 1994.** Barger, V.; Camerini, U.; Carlsmith, D.; Durand, B.; Durand, L.; Erwin, A.; Fry, W.; Goebel, C.; Halzen, F.; Loveless, R. Wisconsin Univ., Madison, WI (USA). 1989. 415p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER00881. Order Number DE89014506/JAW. Available from NTIS, PC A18/MF A01 - OSTI; GPO Dep.

This paper contains task reports on the following topics: Hadron physics at Fermilab; Lepton hadron scattering; Electroweak and weak interactions at the Stanford Linear Accelerator Center; Hyperon beam program/hadroproduction of heavy flavors at Fermilab; High energy physics colliding beam detector facility at Fermilab; Data analysis facility; Institute for Elementary Particle Physics research; Study of weak and electromagnetic interactions at Desy and Cern; Theoretical high energy physics; Dumand; and Ultra high energy gamma rays. (LSP)

37492 (DOE/ER/03130–3) **Progress report for a research program in computational physics.** Guralnik, G.S. Brown Univ., Providence, RI (USA). 1989. 4p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER03130. Order Number DE89013952/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This work has been going on for several years and has encompassed many aspects of the field, including algorithms, machines, theoretical studies and large scale simulations. This last year we made progress in the following areas: studies of QCD including the effects of dynamical fermions, large scale simulations (in particular the calculation of matrix elements for hadronic weak interactions), and in new algorithms. We describe these in this paper.

37493 (DOE/ER/03130–425) **Progress report for a research program in theoretical high energy physics.** Feldman, D.; Fried, H.M.; Jevicki, A.; Kang, Kyungsik; Tan, Chung-I. Brown Univ., Providence, RI (USA). Dept. of Physics. 30 Jun 1989. 26p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER03130. Order Number DE89013963/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This year's research has dealt with: superstrings in the early universe; the invisible axion emissions from SN1987A; quartic interaction in Witten's superstring field theory; W-boson associated multiplicity and the dual parton model; cosmic strings and galaxy formation; cosmic strings and baryogenesis; quark flavor mixing; $p - \bar{p}$ scattering at TeV energies; random surfaces; ordered exponentials and differential equations; initial value and back-reaction problems in quantum field theory; string field theory and Weyl invariance; the renormalization group and string field theory; the evolution of scalar fields in an inflationary universe, with and without the effects of gravitational perturbations; cosmic string catalysis of skyrmion decay; inflation and cosmic strings from dynamical symmetry breaking; the physic of flavor mixing; string-inspired cosmology; strings at high-energy densities and complex temperatures; the problem of non-locality in string theory; string statistical mechanics; large-scale structures with cosmic strings and neutrinos; the delta expansion for stochastic quantization; high-energy neutrino flux from ordinary cosmic strings; a physical picture of loop bremsstrahlung; cylindrically-symmetric solutions of four-dimensional sigma models; large-scale structure with hot dark matter and cosmic strings; the unitarization of the odderon; string thermodynamics and conservation laws; the dependence of inflationary-universe models on initial conditions; the delta expansion and local gauge invariance; particle physics and galaxy formation; chaotic inflation with metric and matter perturbations; grand-unified theories, galaxy formation, and large-scale structure; neutrino clustering in cosmic-string-induced wakes; and infrared approximations to nonlinear differential equations. 17 refs.

37494 (DOE/ER/03230–T8) **Research in elementary particle physics: Technical progress report, June 1, 1988–May 31, 1989.** Kirsch, L.E.; Schnitzer, H.J.; Abbott, L.F.; Bensinger, J.R.; Blocker, C.A. Brandeis Univ., Waltham, MA (USA). Dept. of Physics. 1989. 18p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER03230. Order Number DE89014534/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper discusses the following topics: electroweak decays; search for top decay into leptons; search for top decay into jets; electron photon algorithm group; jet momenta corrections; superconducting supercollider program; strings and conformal field theories; quantum gravity and wormholes; and neural networks. (LSP)

37495 (DOE/ER/40253–148) **[Studies of elementary particles and high energy phenomena: [Progress report].** Cumalat, J.P. Colorado Univ., Boulder, CO (USA). [1989]. 49p. Sponsored by DOE Energy Research. DOE Contract AC02-86ER40253. Order Number DE89014168/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The scope of work under this contract is unclassified and shall consist of experimental, theoretical, and phenomenological research on the fundamental properties of high energy subnuclear particles at the Fermi National Accelerator Laboratory, the Stanford Linear Accelerator Center, the Los Alamos National Laboratory, the SSC laboratory, and the University of Colorado with emphasis on photon beam experiments, electron-positron interactions, charmed particles, production of new vector bosons, advanced data acquisition systems, two photon physics, particle lifetimes, supergravity, supersymmetry, superstrings, quantum chromodynamics, nonequilibrium statistical mechanics, cosmology, phase transitions, lattice gauge theory, anomaly-free theories, gravity and instrumentation development. These topics are covered in this report.

37496 (DOE/ER/40315–160) **Report of the kaon subcommittee of nuclear science advisory committee: Final report.** Barnes, P.D.; Domingo, J.; Einhorn, M.; Feshbach, H.; Jackson, H.; Sirmann, R.; Zeller, M. Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Physics. 3 May 1989. 46p. Sponsored by DOE Nuclear Energy. DOE Contract FG02-87ER40315. Order Number

DE89014474/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper discusses the possibility of a joint US-Canada venture in support of a kaon "factory" to be built in Canada also discussed are the following topics: Proposed accelerator; anially costs at KAON; management; strong interaction physics at AHF/KAON; antiproton physics at AHF/KAON, and electroweak physics issues. (LSP)

6451 Particle Interactions and Properties - Experimental

Refer also to citation(s) 37518, 37527, 37563, 37566, 37583

37497 (BNL–42049) **BNL workshop on rare K decays and CP violation, August 25-27, 1988.** Brookhaven National Lab., Upton, NY (USA). Oct 1988. 319p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-880861–Vugraphs: Workshop on rare K decays and CP violation, Upton, NY, USA, 25-27 Aug 1988). Order Number DE89014420/JAW. Available from NTIS, PC A14/MF A01 - OSTI.

This report contains viewgraphs on the following topics: rare and forbidden K decays; CP violation in the K system; the status of current experiments at BNL, CERN, FNAL, and KEK; and future experiments and facilities.

37498 (CONF-8905143–2) **Probing nuclear currents with dilepton production in ultrarelativistic heavy-ion collisions.** Bottcher, C.; Strayer, M.R.; Albert, C.; Ernst, D.J. Oak Ridge National Lab., TN (USA). 1989. 9p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From NATO international advanced courses on the nuclear equation of state; Peniscola, Spain; 12 May - 3 jun 1989. Order Number DE89014094/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this paper we discuss the coherent production of μ and τ pairs perturbatively in the two-photon limit. Previous calculations of cross sections have been reported using the Weizsaecker-Williams method; however, serious objections have been raised to the use of such methods. Approaches which do not impose the constraint that the photons are "on-shell" usually give different results due to the breakdown of the equivalent photon approximation. The breakdown of the equivalent photon approximation usually occurs at the same level as the coupling to the nuclear currents. For example, nucleons in nuclei can "carry" a large momentum. Form factors controlling the coupling of protons to photons regulate the magnitude of the pair vertex. In the Weizsaecker-Williams method, these form factors cannot be treated properly. Even though the pair production is nonperturbative at the highest energies, the introduction of nucleon form factors tends to regularize perturbation theory, and Feynman theory can be used to address details of the hadron-photon couplings and their effect on the dilepton cross sections. Calculations of this type have been used to study anomalous electron pair production in π^-p collisions. In the present work we shall use perturbation theory to study μ and τ lepton production and to explore the sensitivity of the cross sections to a range of plausible models for the nuclear form factors. 13 refs., 6 figs.

37499 (DOE/ER/03130–46C) **Elastic scattering of muon-neutrinos and muon-anti-neutrinos by electrons.** Abe, K.; Ahrens, L.A.; Amako, K.; Aronson, S.H.; Beier, E.W.; Callas, J.L.; Cutts, D.; Diwan, M.V.; Durkin, L.S.; Gibbard, B.G. Brown Univ., Providence, RI (USA). 1989. 4p. Sponsored by DOE/ER;FOR. DOE Contract AC02-76ER03130. (CONF-8904226–3: 12. international workshop on weak interactions and neutrinos, Ginosar, Israel, 9-14 Apr 1989). Order Number DE89013957/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Final results are presented from an experiment on elastic scattering of neutrinos by electrons. New determinations of the electro-weak mixing parameter, $\sin^2\theta_W$, are made using both total and differential cross sections. Limits are set on possible electromagnetic structure of the muon-neutrino. 7 refs., 2 figs., 1 tab.

37500 (DOE/ER/03130–50C) **Progress report of a research program in experimental high energy physics, January 1, 1989–December 31, 1989.** Lanou, R.E. Jr.; Cutts, D. Brown Univ., Providence, RI (USA). Dept. of Physics. 1 Jul 1989. 33p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER03130. (COO–3130TC-50). Order Number DE89013962/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An experimental program in strong and electro-weak interaction physics of elementary particles is being carried out using electronic detection techniques. Experiments have been performed at Brown, Brookhaven, and Fermilab. The work described in this report by the Electronic Detector Group addresses the following: electroweak parameters via neutrino interactions, preparations for experiments ("D-ZERO") at the FNAL 2 TeV $\bar{p}p$ Collider, new detection techniques for neutrino properties.

37501 (DOE/ER/03130–267) **Progress report of a research program in experimental high energy physics: Task B: Progress report, January 1–December 31, 1989.** Widgoff, M. Brown Univ., Providence, RI (USA). Dept. of Physics. 1 Jul 1989. 31p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER03130. Order Number DE89013950/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The group at Brown has joined a collaboration to carry out experiments in high energy physics using astrophysical sources, in the new underground laboratory at Gran Sasso. We are building a detector (LVD) which includes a large volume of liquid scintillator together with a multilayered omnidirectional tracking system of high spatial and angular resolution, in order to study particle physics in a domain beyond the range of accelerators now or soon to be available. Among the physics questions we will be able to address very effectively are neutrino oscillations, discrete sources of high energy radiation including muons and neutrinos, dark matter and exotic particles, neutrinos from stellar collapse, and monopoles. The hybrid detector built by the E745 Collaboration, with the Tohoku one-meter holographic freon bubble chamber as target, had a second successful run at the Tevatron during 1987, the film from which is being analyzed. The production of neutral strange particles by muon neutrinos at Tevatron energies has been investigated using the data from the 1985 run, and this study will be greatly enhanced by the addition of the events from the 1987 run. Other physics topics include a new method of observing an EMC-like effect in the muon neutrino data. A new experiment has been approved (E782) to study the interactions of muons from the Tevatron, using the E745 hybrid system, and we have been preparing for the run scheduled to begin in January 1990. During the past year, analysis has continued both on the data of our experiments concerning interactions of hadrons with protons and heavier nuclei and on the data of SLAC experiments BC72/73/75, studying the interactions in hydrogen of 20 GeV polarized photons.

37502 (DOE/ER/40150–74) **Parity violation workshop.** Siegel, R. (ed.). Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility. Feb 1987. 325p. Sponsored by DOE Energy Research. DOE Contract AC05-84ER40150. (CONF-861277–: Parity violation workshop - CEBAF, Newport News, VA, USA, 11-12 Dec 1986). Order Number DE89014431/JAW. Available from NTIS, PC A14/MF A01 - OSTI.

This report contains papers on the following: the Bates parity violation experiment; parity violation in the nuclear domain; the weak neutral current in the standard model; measurement of parity nonconservation in the proton-proton total cross section at 800 MeV; $p(\vec{e},e)p$ in the standard model; physics and technology of polarized sources; injector for polarized electrons at CEBAF; measurement of the electron beam polarization; high power cryogenic targets; focusing toroidal spectrometer for parity violation experiments; solenoidal field spectrometer for parity violation experiments; experimental areas and spectrometer costs; problems of neutron form factors, reducing spurious asymmetries in parity experiments, and proposed parity experiment at CEBAF; asymmetries in the LAMPF parity experiment; and parity violation in the photodisintegration of deuterium.

37503 (DOE/ER/40315–156) **Hyperon production with antiprotons.** Barnes, P.D.; Birien, P.; Bonner, B.E.; Breunlich, W.; Diebold, G.; Dutty, W.; Eisenstein, R.A.; Ericsson, G.; Eyrich, W.; von Frankenberg, R. PS185 Collaboration. Carnegie-Mellon Univ.,

Pittsburgh, PA (USA). 1989. 13p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER40315. Order Number DE89014470/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Precision measurements of hyperon-antihyperon production with antiprotons permit detailed tests of strange quark pair production and decay. Recent measurements at LEAR of lambda-antilambda production are compared with selected calculations. A recent search in the K_sK_s channel for $\xi(2230)$ formation and possible future searches for CP nonconservation in the lambda-antilambda system are also discussed. 17 refs., 13 figs.

37504 (DOE/ER/40315–158) **Lambda-antilambda decay asymmetries and CP violation.** Hertzog, D.W.; Barnes, P.D.; Birien, P.; Bonner, B.E.; Breunlich, W.; Diebold, G.; Dutty, W.; Eisenstein, R.A.; Ericsson, G.; Eyrich, W. PS185 collaboration. Carnegie-Mellon Univ., Pittsburgh, PA (USA). 1988. 9p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER40315. (CONF-880983–38: 8. international symposium on high energy spin physics, Minneapolis, MN, USA, 12-17 Sep 1988). Order Number DE89014472/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The exclusive reaction $\bar{p}p \rightarrow \bar{\Lambda}\Lambda$ is an interesting laboratory in which to study both spin physics and fundamental symmetries. The PS185 collaboration at LEAR has been exploiting this fact for the last few years in an ongoing program of hyperon-antihyperon production. The motivation for this study will be outlined and the experimental technique will be described. Spin physics aspects such as the measurements of the outgoing hyperon polarization and preliminary determinations of spin correlation coefficients will be presented. Fundamental symmetry checks such as lifetime differences between Λ and $\bar{\Lambda}$ (CPT) and decay properties (CP) will be discussed. A future experiment which is quite sensitive to CP violation in a hyperon-antihyperon system will be mentioned. 15 refs., 4 figs.

37505 (DOE/ER/40315–159) **Strangeness production with antiprotons at LEAR.** Barnes, P.D.; Birien, P.; Bonner, B.E.; Breunlich, W.H.; Diebold, G.; Dutty, W.; Eisenstein, R.A.; Ericsson, G.; Eyrich, W.; Fischer, H. Carnegie-Mellon Univ., Pittsburgh, PA (USA); Freiburg Univ. (Germany, F.R.). Fakultaet fuer Physik. 3 Nov 1988. 13p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER40315. (CONF-8809218–3: 9. European symposium on antiproton-proton interactions and fundamental symmetries, Mainz, Germany, F.R., 5-9 Sep 1988). Order Number DE89014473/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The reaction $\bar{p}p \rightarrow \bar{Y}Y$ is being investigated at LEAR in the energy range from threshold up to 2.0 GeV/c. Integrated and differential cross sections as well as polarizations have been measured at six energies for the $\bar{\Lambda}\Lambda$ channel. At 1.546 GeV/c also spin correlations have been determined. The results are discussed and compared with different theoretical predictions. First and preliminary results on the reaction $\bar{p}p \rightarrow K_sK_s$ in the energy range of the hypothetical $\xi(2232)$ resonance are presented. The cross section is flat, and shows no indication of a structure. 26 refs., 12 figs.

37506 (DOE/ER/40323–T2) **Medium energy meson research.** Crowe, K.M. California Univ., Berkeley, CA (USA). Dept. of Physics. [1989]. 17p. Sponsored by DOE Energy Research. DOE Contract FG03-87ER40323. Order Number DE89014124/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The measurements completed in major runs up to 1987 have been under detailed analysis. The experiments discussed in this paper are: pion-helium scattering; proton pion bremsstrahlung; muon decay spectrum-η; muon catalyzed fusion; and Crystal Barrel jet drift chamber.

37507 (GSI–89-33(prepr.)) **Search for resonant Bhabha scattering at MeV energies.** Tsertos, H. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.). Apr 1989. 15p. (CONF-8903138–: ILL workshop on fundamental physics with slow neutrons, Grenoble, France, 8-11 Mar 1989). Available from Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

A series of investigations on Bhabha scattering has been carried out in the last two years, searching for possible neutral resonances in the invariant mass range between 1.5 and 1.9 MeV/c^2, as motivated by the heavy-ion experiments at GSI. The currently highest sensitivity has been achieved by an experiment performed at ILL using the BILL β spectrometer to produce monoenergetic positrons and a high-resolution multidetector device. With systematic and statistical uncertainties of less than 0.25%, no evidence for any resonance was found around 1.8 MeV/c^2. The 97%-confidence upper limit on the intrinsic width and lifetime of a hypothetical spinless resonance is 1.9 meV and 3.5×10^{-13} s, respectively, establishing the most stringent bound for new particles in this mass region.

37508 (INIS-mf–11456, pp. 413-416) **Experiments with one-meter hydrogen bubble chamber in beams of relativistic light nuclei.** Sandor, L. (Slovenska Akademia Vied, Kosice (Czechoslovakia). Ustav Experimentalnej Fyziky); Urban, J. Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1987. (In Slovak). (CONF-8707217–: 9. conference of Czechoslovak physicists, Pardubice, Czechoslovakia, 6-10 Jul 1987). In *Ninth conference of Czechoslovak physicists. Part 1, 2.* Order Number DE89617602/JAW. Available from NTIS (US Sales Only), PC A22/MF A01 - OSTI; INIS.

The experiment is described in which the interaction was studied of a beam of relativistic ^{4}He nuclei with H in a one–metre bubble chamber. The experiment was carried out at the synchrophasotron at the JINR in Dubna. The processes were analyzed of fragmentation of helium nuclei on protons in the energy range of 2 to 4 GeV/nucleon. Some results are given of the study of the exclusive process ^{4}Hep->dppn at a ^{4}He momentum of 8.6 GeV/c when 40,000 interactions were analyzed. (Z.J.). 3 figs., 14 refs.

37509 (LAL–88-14) **Neutrino counting in single photon experiments.** Grivaz, J.F. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Jun 1988. 4p. (CONF-8803109–: 23. Rencontre de Moriond conference: electroweak interactions and unified theories, Les Arcs, France, 6-12 Mar 1988). Order Number DE89776419/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

The results from single photon experiments are reviewed and combined. The 90 % CL upper limit on the number of light neutrino species is 4.6, and the 90 % CL lower limit on the mass of two degenerate scalar electrons is 68.5 GeV for massless photinos.

37510 (LA-UR–89-1751) **Physics with ETA mesons.** Liu, Lon-chang. Los Alamos National Lab., NM (USA). 1989. 16p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8904233–1: Symposium on pion-nucleon and nucleon-nucleon physics, Leningrad, USSR, 22-27 Apr 1989). Order Number DE89012582/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Since the advent of pion factories, an impressive amount of information about the nuclear dynamics of the $\Delta(1232)$ pion- nucleon resonance has been obtained. The study of this isospin-3/2 resonance has greatly benefited from the fact that π^-n and π^+p systems are pure I = 3/2 states, which couple only to the Δ in the resonance region. Such isospin selectivity of the pion does not exist, however, for the I = 1/2 N* resonances because it is not possible to form a pure I = 1/2 state with a pion and a nucleon. Eta mesons have zero isospin. Consequently, the ηN systems are in a pure I = 1/2 state, and η can be used to tag those N* resonances to which it strongly couples. We will briefly review the πN interaction from the threshold region to c.m. energy $\sqrt{s} \simeq 1600$ MeV. We shall see how improved πN data can help the study of πN interactions. I shall discuss what new information about the hadronic interaction can be learned from the study of eta production in pp collisions. The behavior of eta meson in nuclei will be discussed. The interesting question of the quark structure of $\eta(549)$ and $\eta\prime(958)$ will also be discussed within the framework of a simple model. 19 refs., 13 figs.

37511 (LA-UR–89-1871) **Neutrino mass experiments.** Robertson, R.G.H. Los Alamos National Lab., NM (USA). 1989. 14p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8904234–1: 10. and final workshop on grand unification, Chapel Hill, North Carolina, USA, 20-22 Apr 1989). Order Number DE89013464/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The current status of the experimental search for neutrino mass is reviewed, with emphasis on direct kinematic methods. Simpson and Hime report finding new evidence for a 17-keV neutrino in the β decay of ^3H and ^{35}S. The situation concerning the electron neutrino mass as measured in tritium beta decay has not changed significantly in the last two years. We discuss the "model independent" lower limit of 17 eV obtained by the ITEP group in light of existing data on the ^3H–^3He mass difference. 42 refs., 1 fig., 1 tab.

37512 (LA-UR–89-1892) **$K^0_L \rightarrow \mu\mu$ polarization: Future prospects.** Sanders, G.H. Los Alamos National Lab., NM (USA). 1989. 9p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8903132–5: 24. Rencontres de Moriond: electroweak interactions and unified theories, Les Arcs, France, 5-12 Mar 1989). Order Number DE89014239/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The observation of polarized muons in the final state of the decay $K^0_L \rightarrow \mu\mu$ would be an indication of a new CP-noninvariant interaction. The theoretical literature describes a variety of physics mechanisms and many models in which such polarization may appear above the Standard Model background. We review this literature and describe experimental possibilities for carrying out the search for this publication. 19 refs., 7 figs., 1 tab.

37513 (SLAC-PUB–4816) **Z^0 physics at the SLC.** Dorfan, J.M. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Feb 1989. 69p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-8808232–1: Banff summer institute on particles and fields; NATO Advanced Study Institute on techniques and concepts of high energy physics, Banff, Canada; St. Croix, Virgin Islands (U.S.), 14-27 Aug 1988; 14-25 jul 1988;CONF-880717–1). Order Number DE89013749/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper discusses the following topics: the standard model and its application to $e^+e^- \rightarrow Z^0 \rightarrow t\bar{t}$; detector requirements; the upgraded MARKII detector; the physics measurements; searching for the top quark; is there a fourth generation?; Searching for Higgs scalars; and physics beyond the minimal standard model. 13 refs., 34 figs., 11 tabs.

37514 (SLAC-PUB–4985) **Review of "close-mass" heavy lepton searches.** Riles, K. Mark II Collaboration. Stanford Linear Accelerator Center, Menlo Park, CA (USA). May 1989. 11p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-8903132–1: 24. Rencontres de Moriond: electroweak interactions and unified theories, Les Arcs, France, 5-12 Mar 1989). Order Number DE89014591/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Results from recent searches in e^+e^- annihilation at PEP ($\sqrt{s}$ = 29 GeV) for a fourth-generation charged lepton associated with a slightly lighter neutrino partner are presented. Some emphasis is given to the most recent search, which uses a novel approach based on radiative tagging, an approach that holds promise as a general tool in searching for exotic events characterized by very low visible energy. Prospects for upcoming sequential lepton searches at SLC and LEP experiments are also discussed. 11 refs., 4 figs.

37515 **Charm physics.** Purohit, M. V. (Fermi National Accelerator Laboratory, Batavia, IL 60510(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 541-550 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, NY, USA, 29 Aug - 1 sep 1988).

The status of charm physics with emphasis on recent high statistics results from fixed target experiments is presented. The topics covered include charm production, $D^0\bar{D}0 mixing, charm baryons and excited states such as the D^{**}$. Also reviewed are charm decays: hadronic, leptonic as well as semileptonic. Finally, we take a brief look at charm lifetimes before concluding with a look to the future.

6452 Particle Interactions and Properties - Theoretical

Refer also to citation(s) 37515, 37551, 37632, 37638, 37678

37516 (CBPF-NF–054/88) **Predictions about the decays of the B-mesons.** Bediaga, I.; Correa, A.; Predazzi, E. Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ (Brazil). 1988. 16p. (DFTT–19/88). Order Number DE89612602/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Extrapolating to the b sector a model applied to charm decay, the differences expected between B^0_s, B^0_d and B^-_u lifetimes are discussed. No significative differences (<= 5 ~10%) are predicted.

37517 (FNAL/C–89/104-A) **Windows on the axion.** Turner, M.S. Fermi National Accelerator Lab., Batavia, IL (USA). Apr 1989. 39p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-8904224–1: Cosmic axion workshop, Upton, New York, USA, 13-14 Apr 1989). Order Number DE89013151/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Peccei-Quinn symmetry with attendant axion is a most compelling, and perhaps the most minimal, extension of the standard model, as it provides a very elegant solution to the nagging strong CP-problem associated with the Θ vacuum structure of QCD. However, particle physics gives little guidance as to the axion mass; a priori, the plausible values span the range: 10^{-12} eV $\lesssim m_a \lesssim 10^6$ eV, some 18 orders-of-magnitude. Axions have a host of interesting astrophysical and cosmological effects, including, modifying the evolution of stars of all types (our sun, red giants, white dwarfs, and neutron stars), contributing significantly to the mass density of the Universe today, and producing detectable line radiation through the decays of relic axions. Consideration of these effects has probed 14 orders-of-magnitude in axion mass, and has left open only two windows for further exploration: 10^{-6} eV $\lesssim m_a \lesssim 10^{-3}$ eV and 1 eV $\lesssim m_a \lesssim$ 5 eV (hadronic axions only). Both these windows are accessible to experiment, and a variety of very interesting experiments, all of which involve "heavenly axions," are being planned or are underway. 58 refs., 6 figs., 1 tab.

37518 (IFVE-OEIUNK/OTF–88-65) **High-energy physics. Panorama of programs. Description of the problem situation.** Alekhin, S.I.; Ezhela, V.V.; Pirogov, Yu.F. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij. 1988. 66p. (In Russian). Order Number DE89618892/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The problem situation of current high energy physics is presented from the phenomenological point of view. Compilation of physics goals for different existing, constructed and planned accelerators of high energy and or high intensity or luminosity is presented. 26 refs.

37519 (INIS-mf–11440, pp. 199-200) **Cumulative π^- production in 4.5 AGeV/c He induced reactions.** Besliu, C. (Bucharest Univ. (Romania)); Jipa, A.; Olariu, A.; Topor-Pop, R.; Popa, L.; Popa, V.; Topor-Pop, V. Central Inst. of Physics, Bucharest (Romania). 1988. (In Romanian). (CONF-8810372–: Advances in physics, Constanta, Romania, 6-8 Oct 1988). In *Advances in Physics.* Order Number DE89012158/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Some preliminary results on the spectra of cumulative pions produced in He-nuclei interactions, at 4.5 AGeV/c, obtained using the SKM-200 spectrometer at IUCN-Dubna. (authors).

37520 (INIS-mf–11440, pp. 191-192) **New results on narrow dibaryns produced in np-ppPI$^-$ at 1.25 Gev/c.** Arakelian, S.G. (Joint Inst. for Nuclear Research, Dubna (USSR)); Yerusalimov, A.P.; Moroz, V.I.; Nikitin, A.V.; Pecenov, V.N.; Ravinovici, I.M.; Stelmakh, A.P.; Troyan, Y.A.; Besliu, C.; Cotorobai, F. Central Inst. of Physics, Bucharest (Romania). 1988. (In Romanian). (CONF-8810372–: Advances in physics, Constanta, Romania, 6-8 Oct 1988). In *Advances in Physics.* Order Number DE89012158/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

In the reaction np-ppπ^- at 1.25 GeV/c, using an enhanced experimental statistics new peaks in the two proton effective mass distribution were observed. (auhtors).

37521 (INIS-mf–11440, pp. 197-198) **On the possiility that (7q,q-bar) resonances decay into (6q) dibaryons.** Arakelian, S.G. (Joint Inst. for Nuclear Research, Dubna (USSR)); Yerusalimov, A.P.; Moroz, V.I.; Nikitin, A.V.; Pecenov, V.N.; Ravinovici, I.M.; Stelmakh, A.P.; Troyan, Y.A.; Besliu, C.; Cotorobai, F. Central Inst. of

Physics, Bucharest (Romania). 1988. (In Romanian). (CONF-8810372–: Advances in physics, Constanta, Romania, 6-8 Oct 1988). In *Advances in Physics*. Order Number DE89012158/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The hypothesis that (7q,q-bar) non-strange resonances observed in the np interactions at 5.1 GeV/c could decay via dibaryonic (6q) resonances is discussed. (authors).

37522 (INIS-mf–11440, pp. 224-225) **Semiclassical approach to particle resonances and dibaryons.** Nichitiu, F. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Central Inst. of Physics, Bucharest (Romania). 1988. (In Romanian). (CONF-8810372–: Advances in physics, Constanta, Romania, 6-8 Oct 1988). In *Advances in Physics*. Order Number DE89012158/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Using the semiclassical picture proposed by Arndt and Roper for Δ_{33} resonance, in this work we show that the other resonances as well as dibaryons can be described by this approach.

37523 (INIS-mf–11440, pp. 226-227) **Molecular picture for dibaryons.** Nichitiu, F. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering). Central Inst. of Physics, Bucharest (Romania). 1988. (In Romanian). (CONF-8810372–: Advances in physics, Constanta, Romania, 6-8 Oct 1988). In *Advances in Physics*. Order Number DE89012158/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

We try to suggest that the threshold effects and the rotational-like behaviour of the resonances masses seems to hide a common molecular picture for the low mass dibaryon resonances.

37524 (INS–732) **Super-hypernuclei in the quark-shell model.** Terazawa, Hidezumi. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Jan 1989. 27p. Order Number DE89790947/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

A super-hypernucleus is a nucleus which consists of many strange quarks as well as up and down quarks. An important part of the results of our recent investigation on the mass spectrum and other properties of super-hypernuclei in the quark-shell model is reported. It is expected that not only certain exotic nuclei such as the 'dideltas' ($D\delta^{++++}$ and $D\delta^{----}$). but also certain super-hypernuclei such as the 'hexalambda' ($H\lambda$) and the 'vigintiquattuoralambda' ($Vq\lambda$) may appear as quasi-stable nuclei. However, in the quark-shell model, there is no qualitative reason why the 'dihyperon' or 'H dibaryon' (H) should be quasi-stable or even stable. Many other predictions including a sudden increase of the K/π ratio due to the production of super-hypernuclei in heavy-ion collisions at high energies are also made.

37525 (INS–737) **Compactification of space-time in SU(∞) Yang-Mills theory.** Shiraishi, Kiyoshi. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Feb 1989. 15p. Order Number DE89790949/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The compactification on torus in SU(∞) Yang-Mills (YM) theory is considered. A special form of configuration of gauge field on torus is examined. The vacuum energy and free energy in the presence of fermions coupled with this background in the theory are derived and possible symmetry breaking is investigated.

37526 (LA-UR–89-1918) **Precision electroweak physics with neutrinos at Los Alamos.** Sanders, G.H. Los Alamos National Lab., NM (USA). 1989. 8p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8903132–6: 24. Rencontres de Moriond: electroweak interactions and unified theories, Les Arcs, France, 5-12 Mar 1989). Order Number DE89014025/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We review the status of current efforts at Los Alamos to measure the mass of $\bar{\nu}_e$ with tritium beta decay and to search for oscillation of $\bar{\nu}_\mu$ to $\bar{\nu}_e$. A new proposal to carry out a precision measurement of the electroweak mixing angle, θ_W, using neutrino-electron scattering measured in a 7000-ton water Čerenkov detector, the Large Čerenkov Detector (LCD), is described. 17 refs., 6 figs., 1 tab.

37527 (LBL–27134) **Present and future searches for the Higgs Boson with the MEVVA high current metal ion source.** Cahn, R.N. Lawrence Berkeley Lab., CA (USA). May 1989. 6p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8904226–2: 12. international workshop on weak interactions and neutrinos, Ginosar, Israel, 9-14 Apr 1989). Order Number DE89013671/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper discusses the following topics: β decay to Higgs; upsilon decay; Z decay; e^+e^- above the Z; and very high energy hadron colliders. 26 refs., 4 figs. (LSP)

37528 (NBI-HE–89-17) **What is special about the group of the standard model?.** Nielsen, H.B.; Brene, N. Niels Bohr Inst., Copenhagen (Denmark). Mar 1989. 8p. Order Number DE89783574/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

The standard model is based on the algebra of $U_1xSU_2xSU_3$. The systematics of charges of the fundamental fermions seems to suggest the importance of a particular group having this algebra, viz. $S(U_2xU_3)$. This group is distinguished from all other connected compact non semisimple groups with dimensionality up to 12 by a characteristic property: it is very 'skew'. By this we mean that the group has relatively few 'generalised outer automorphisms'. One may speculate about physical reasons for this fact.

37529 (NORDITA–89/8-P(prepr.)) **Couplings in the heterotic superconformal three generation model.** Greene, B.R.; Ross, G.G.; Luetken, C.A. Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Harvard Univ., Cambridge, MA (USA). Lyman Lab. of Physics; Oxford Univ. (UK). Dept. of Theoretical Physics. 1989. 35p. (HUTP–88/A062). Order Number DE89783575/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

We compute all Yukawa couplings in the three generation string theory recently constructed by Gepner by tensoring solvable N=2 superconformal theories. The results are consistent with those obtained by a geometric analysis of the field theory limit where the model reduces to a compactification on an algebraic manifold of the Calabi-Yau type.

37530 (RRK–89-9) **Gauge invariant cosmological perturbations with cold dark matter.** Sugiyama, Naoshi. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Feb 1989. 33p. Order Number DE89790940/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

In the gauge-invariant formalism, the evolution of adiabatic and baryonic isocurvature density perturbations in a universe dominated by cold dark matter (CDM) is thoroughly investigated. We evaluate anisotropies in the cosmic microwave background (CMB) and large scale peculiar velocities. From the recent observations of CMB fluctuations, we find new and stringent constraint is obtained for adiabatic CDM models as $\Omega_0\ h^{-1} > 0.3$. As for baryonic isocurvature perturbations, though the constraint is required as $\Omega_0\ h^{-1} >$approx 0.6, we find these baryonic isocurvature models are more viable than axion isocurvature models. However it is difficult for both adiabatic and baryonic isocurvature CDM models to explain to observed large scale velocity field at >approx $50h^{-1}$ Mpc while being consistent with the observations of CMB anisotropies.

37531 (SLAC-PUB–4881) **The search for charged-lepton specific forces and the PEGASYS facility.** Perl, M.L. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Feb 1989. 13p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-8901115–2: Topical conference on electronuclear physics with internal targets, Stanford, California, USA, 9-12 Jan 1989). Order Number DE89013747/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper discusses the electroproduction of lepton pairs as a method of searching for a charged-lepton specific force, and as a general method of searching for deviations from conventional quantum electrodynamics. The use of the PEGASYS facility for these purposes is briefly described. Search possibilities in other energy ranges are noted. 22 refs., 11 figs.

37532 (SLAC-PUB–4955) **Heavy quark physics.** Gilman, F.J. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Apr 1989. 48p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-881292–1: 3. Mexican school of particles

and fields, Cuernavaca, Mexico, 5-16 Dec 1989). Order Number DE89014589/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Various aspects of the physics of heavy quarks and of CP violation are reviewed. 76 refs., 19 figs.

37533 (SLAC-PUB–4973) **CP violation in K decays.** Gilman, F.J. Stanford Linear Accelerator Center, Menlo Park, CA (USA). May 1989. 29p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-8902110–2: 2. international symposium on the 4th family of quarks and leptons, Santa Monica, California, USA, 23-25 Feb 1989). Order Number DE89014593/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Recent theoretical and experimental progress on the manifestation of CP violation in K decays, and toward understanding whether CP violation originates in a phase, or phases, in the weak mixing matrix of quarks is reviewed. 23 refs., 10 figs.

37534 (SLAC-PUB–4983) **Quark mass ratios in semi-leptonic quark decays.** Nir, Yosef. Stanford Linear Accelerator Center, Menlo Park, CA (USA). May 1989. 8p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-8902110–1: 2. international symposium on the 4th family of quarks and leptons, Santa Monica, California, USA, 23-25 Feb 1989). Order Number DE89013751/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An ambiguity in the calculation of CKM matrix elements from semi- leptonic decay rates is resolved: to every choice of scales for the quark masses in the phase-space factor and in the QCD-correction factor, there corresponds a specific QCD-correction factor. This factor is modified in such a way as to make the final result independent of the scales. Specific expressions are given for the case of on-shell quark masses and for the case where both masses are taken at a single common scale. A calculation of $|V_{cb}|$ and $|V_{ub}/V_{cb}|$ is carried out in view of these clarifications. 5 refs.

37535 (SLAC-PUB–4987) **What do we know (and how) about the CKM [Cabibbo-Kobayashi-Maskawa] matrix.** Nir, Y. Stanford Linear Accelerator Center, Menlo Park, CA (USA). May 1989. 9p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-8904226–1: 12. international workshop on weak interactions and neutrinos, Ginosar, Israel, 9-14 Apr 1989). Order Number DE89014587/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The way from an experimental measurement to the numerical value for a CKM matrix element is described. How do we choose the appropriate model? What are the uncertainties involved? Where should we direct our future efforts? How do loop processes help us? Finally we describe the state of the art of our knowledge of the CKM matrix. 6 refs.

37536 Complete computation of high-p_T W and Z production in second-order QCD. Arnold, P.B. (Argonne National Lab., IL (USA). High Energy Physics Div.); Hall Reno, M. *Nuclear Physics [Section] B (Netherlands),* 319(1): 37-71 (5 Jun 1989).

We present a full computation of $d\sigma/dq_T^2$ for W, Z and virtual γ production to second order in QCD. This includes qg, gg, and singlet qanti q + qq collisions in addition to the usual non-singlet qanti q + qq. The primary motivation is the importance of quark-gluon collisions at Tevatron energies. Attention is restricted to high and moderate q_T, avoiding the resummation necessary at small transverse momentum. We give analytic results for all constituent cross-sections $d\sigma/dq_T^2$ dy and, for W and Z production, numerically convolute them with structure functions.

37537 Three-body unitarity, the cloudy bag model, and the Roper resonance. Pearce, B. C. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)); Afnan, I. R. *Physical Review [Section] C: Nuclear Physics (USA),* 40(1): 220-236 (Jul 1989).

We present the details and results of a Faddeev calculation of πNscattering in the P_{11} channel in the region of the Roperresonance. Our equations respect two- and three-body unitarity, treat thenucleon and delta on an equal footing, and have a pole with correct residue atthe nucleon mass. The input is from the cloudy bag model. Resonance behavior isexhibited without the inclusion of a bare Roper bag, although not in detailedagreement with experiment. If a bare Roper bag is included, the phase shiftsvary far too rapidly in the resonance region, implying that identifying thelowest radial bag excitations with the Roper leads to a physical Roper that ismuch too narrow.

37538 B->$X_s e^+e^-$ in the six-quark model. Grinstein, B. (Lawrence Berkeley Lab., CA (USA)); Savage, M.J.; Wise, M.B. *Nuclear Physics [Section] B (Netherlands),* 319(2): 271-290 (12 Jun 1989). DOE Contract AC03-76SF00098;AC03-81ER40050;FG03-84ER40172.

We compute the inclusive rate for a B-meson to decay to strange hadronic final states and a large mass electron-positron pair: B->$X_s e^+e^-$. The dependence of the rate on the invariant mass of the e^+e^- pair is examined. The computation is done in the standard six-quark model with a minimal Higgs sector and in extensions of the standard model with two Higgs doublets. For e^+e^- pairs with very large invariant mass the strange hadronic final states X_s must have low mass. In this kinematic region we estimate the rate for B->Ke^+e^- using the nonrelativistic quark model.

37539 Two-scale technicolor. Lane, K. (Boston Univ., MA (USA). Dept. of Physics); Eichten, E. *Physics Letters [Section] B (Netherlands),* 222(2): 274-280 (18 May 1989). DOE Contract AC02-86ER40284.

Walking technicolor theories naturally have fermions belonging to different technicolor representations and, therefore, at least two distinct energy scales below 1 TeV. We study a simplified two-scale version without ordinary color. We show that masses of light-scale technipions and technirhos are such that the latter tend always to decay to at least one $W^{\pm}$ or Z^0. This signature should be observable at the Tevatron collider for technirho masses up to 300 GeV.

37540 Multiplicity fluctuations in finite rapidity windows. intermittency or quantum statistical correlation?. Carruthers, P. (Arizona Univ., Tucson (USA). Dept. of Physics); Friedlander, E.M.; Shih, C.C.; Weiner, R.M. *Physics Letters [Section] B (Netherlands),* 222(3/4): 487-492 (25 May 1989). DOE Contract AC03-76SF00098.

It is shown that the experimentally observed dependence of moments of multiplicity distributions on the width of the rapidity window can be interpreted by simple quantum statistical properties of the emitting system(s) and does not necessarily imply evidence for intermittency.

37541 Ground state of high-density matter. Copeland, E. (Fermi National Accelerator Lab., Batavia, IL (USA). NASA/Fermilab Astrophysics Center); Kolb, E.W.; Lee, K. *Nuclear Physics [Section] B (Netherlands),* 319(3): 501-510 (19 Jun 1989).

It is shown that if an upper bound to the false vacuum energy of the electroweak Higgs potential is satisfied, the true ground state of high-density matter is not nuclear matter, or even strange-quark matter, but rather a non-topological soliton where the electroweak symmetry is exact and the fermions are massless. We examine this possibility in the standard $SU(3)_C$ x $SU(2)_L$ x $U(1)_Y$ model. The bound to the false vacuum energy is satisfied only for a narrow range of the Higgs boson masses in the minimal electroweak model (within a few eV of its minimum allowed value of 6.6 GeV), and a somewhat wider range for electroweak models with a non-minimal Higgs sector.

37542 Enhanced CP violations in hadronic charm decays. Golden, M. (Fermi National Accelerator Lab., Batavia, IL (USA)); Grinstein, B. *Physics Letters [Section] B (Netherlands),* 222(3/4): 501-506 (25 May 1989).

The observation of CP violation in the decay of D mesons will not necessarily be a signal of new physics. If certain strong interaction matrix elements are enhanced, in analogy to the $\Delta I=1/2$ rule of K decays, then CP violation will be observable in strangeness conserving decays.

6453 Particle Invariance Principles and Symmetries

37543 (LAL–88-29) **Tests of QCD in photoproduction.** Wormser, G.; The NA 14 Collaboration. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Jun 1988. 9p. (CONF-8803214–: Lake Louise Winter Institute meeting, Alberta, CA, USA,

6-12 Mar 1988). Order Number DE89776424/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

The quantitative tests of perturbative QCD performed in high p_T photoproduction by the NA14 experiment are reviewed. Preliminary results are reported on charm photoproduction, where both perturbative and non-perturbative aspects of QCD can be tested, using the high quality data provided by a Silicon microvertex detector.

37544 (LAL–88-36) **First evidence for direct cp violation.** Schaffer, A.C.; CERN-Dortmund-Edinburgh-Mainz-Orsay-Pisa-Siegen Collaboration. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Jun 1988. 10p. (CONF-8803109–:). Order Number DE89776418/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

The double ratio R of the relative decay rates of the short-and long-lived neutral kaons into two charged and two neutral pions was measured to be $0.980 \pm 0.004 \pm 0.005$. The deviation of R from unity implies CP violation in the transition of the CP-odd K_2 into two pions with $\epsilon'/\epsilon = (3.3 \pm 1.1) \times 10^{-3}$.

6454 Field Theory

Refer also to citation(s) 37517, 37637

37545 (ANL-HEP-CP–89-36) **New infinite-dimensional algebras, sine brackets, and SU (∞).** Zachos, C.K.; Fairlie, D.B. Argonne National Lab., IL (USA). High Energy Physics Div. 1989. 9p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-8903130–1: Strings '89 conference, College Station, TX, USA, 13-18 Mar 1989). Order Number DE89013178/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We investigate the infinite dimensional algebras we have previously introduced, which involve trigonometric functions in their structure constants. We find a realization for them which provides a basis-independent formulation, identified with the algebra of sine brackets. A special family of them, the cyclotomic ones, contain SU(N) as invariant subalgebras. In this basis, it is evident by inspection that the algebra of SU(∞) is equivalent to the centerless algebra of $SDiff_0$ on two-dimensional manifolds. Gauge theories of SU(∞) are thus simply reformulated in terms of surface (sheet) coordinates. Spacetime-independent configurations of their gauge fields describe strings through the quadratic Schild action. 11 refs.

37546 (BONN-HE–89-1) **On the construction of certain instanton bundles over flat tori.** Schenk, H. Bonn Univ. (Germany, F.R.). Physikalisches Inst. Mar 1989. 26p. Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.

It is well known that the anti-self-dual solutions to the Yang-Mills equations over Kaehler manifolds correspond to certain stable holomorphic vector bundles called instanton bundles. In this paper we explicitly construct several instanton bundles over flat tori. In particular it is possible to obtain all su(2) instantons with Euler characteristic -2 or -3 by our constructions.

37547 (CRN-HE–85-06) **Direct photon and π^0 production by deep inelastic scattering of real photons inclusive and exclusive studies.** Bloch, D. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France). 1985. 193p. (In French). Order Number DE89789234/JAW. Available from NTIS (US Sales Only), PC A09/MF A01.

The NA14 photoproduction experiment at CERN has investigated the deep inelastic scattering of real photons, with energy between 50 and 150 GeV, in order to reveal the point-like photon-quark interaction. QED Compton scattering $\gamma q \rightarrow \gamma q$ QCD Compton scattering $\gamma q \rightarrow gq$. Results: - evidence for the QCD Compton scattering and test of the validity of perturbative quantum chromodynamics up to the order of ($\alpha\ \alpha_s^2$) (inclusive measurement of the photoproduction cross-section of π^0, with P_T between 1.5 and 4 GeV/c). - Confirmation of the two jets production as predicted by QCD Compton scattering (study of the final state). - Evidence for the QED Compton scattering, including QCD corrections (inclusive observation of a clear prompt photon signal of $P_T > 2.5$ GeV/c, cross-section measurement and exclusive analysis). - Confirmation of the fractional nature of the quark electric charge. Clear disagreement with gauge integer charge quark models (photoproduction of prompt photons).

37548 (FNAL/C–89/116-T) **Macroscopic constraints on string unification.** Taylor, T.R. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 8p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-8903132–4: 24. Rencontres de Moriond: electroweak interactions and unified theories, Les Arcs, France, 5-12 Mar 1989). Order Number DE89014814/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The comparison of sting theory with experiment requires a huge extrapolation from the microscopic distances, of order of the Planck length, up to the macroscopic laboratory distances. The quantum effects give rise to large corrections to the macroscopic predictions of sting unification. I discus the model-independent constraints on the gravitational sector of string theory due to the inevitable existence of universal Fradkin-Tseytlin dilatons. 9 refs.

37549 (FNAL/C–89/125-T) **Machines for lattice gauge theory.** Mackenzie, P.B. Fermi National Accelerator Lab., Batavia, IL (USA). May 1989. 15p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-890415–5: Computing in high energy physics, Oxford, UK, 10-14 Apr 1989). Order Number DE89014815/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The most promising approach to the solution of the theory of strong interactions is large scale numerical simulation using the techniques of lattice gauge theory. At the present time, computing requirements for convincing calculations of the properties of hadrons exceed the capabilities of even the most powerful commercial supercomputers. This has led to the development of massively parallel computers dedicated to lattice gauge theory. This talk will discuss the computing requirements behind these machines, and general features of the components and architectures of the half dozen major projects now in existence. 20 refs., 1 fig.

37550 (INIS-mf–11440, pp. 209-210) **Contribution of the kink-kink interaction to the free energy of a complex scalar nonlinear field.** Grecu, D. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering); Visinescu, A. Central Inst. of Physics, Bucharest (Romania). 1988. (In Romanian). (CONF-8810372–: Advances in physics, Constanta, Romania, 6-8 Oct 1988). In *Advances in Physics*. Order Number DE89012158/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The contribution of the kink-kink interaraction to the free energy of an 1-D nonlinear scalar complex field is obtained in the continuum limit at low temperatures. (authors).

37551 (INS–734) **Charge screening in gauge theories at finite temperature and density.** Yamada, Hirofumi. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. 4 Feb 1989. 12p. Order Number DE89790948/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

We investigate the charge screening in massless QED at finite temperature and density by the use of the renormalization group method. We find that the Debye screening occurs when the temperature and chemical potential are sufficiently smaller than the typical scale of the model. We also find that the Debye mass involves the logarithmic factor which is dependent on the temperature and chemical potential. Charge screening in QCD at finite temperature and density is also investigated and is found to behave unexpectedly.

37552 (JINR-R–5-88-138) **Classification of integrable two-dimensional models of relativistic field theory by means of computer.** Getmanov, B.S.; Kovtun, V.E. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation. 1988. 6p. (In Russian). Order Number DE89618470/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The results of classification of two-dimensional relativistic field models (1) spinor; (2) essentially-nonlinear scalar possessing higher conservation laws using the system of symbolic computer calculations are presented shortly. 13 refs.

37553 (LAL–88-30) **Three and five photon decays of the J/PSI (3097).** Couchot, F.; DM2 Collaboration. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Jun 1988. 4p.

(CONF-8803109–: 23. Rencontre de Moriond conference: electroweak interactions and unified theories, Les Arcs, France, 6-12 Mar 1988). Order Number DE89776423/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

The all-neutral decays of the J/PSI (3097) have been studied using the statistics of 8.6 million J/PSI decays collected with the DM2 detector at the DCI e^+e^- storage rings. The three photon final states give access to precise measurements of BR (J/PSI -> $\gamma \pi^0$) and of the eta mass, and to indirect determinations of the eta'and eta_c branching ratios to two photons. The study of the five photon final states which proceed through $\gamma \pi^0 \pi^0$ or γ eta eta confirms the Crystal ball results on the f_2 (1720).

37554 (LAL–88-37) **Charm photoproduction mechanisms and a few preliminary results from the NA 14' experiment.** Roudeau, P.; N 14 Collaboration. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Jun 1988. 8p. (CONF-8803109–:). Order Number DE89776422/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

A low value for the charm quark mass of 1.2 or 1.3 GeV is ruled out by data on charm photoproduction. Absolute D_s branching ratios will be extracted in the future from these experiments with a systematic uncertainty below 30 %. Possible D^{**} signals are presented.

37555 (NORDITA–89/11-P(prepr.)) **Non renormalization theorem in bosonized n-string formalism.** Nykaenen, E. Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark). 1989. 20p. Order Number DE89783576/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

We examine the non renormalization theorem in one and two loops using the bosonized N-string formalism.

37556 (RRK–88-41) **Relations between Virasoro algebra and Krichever-Novikov algebra on a torus.** Kubo, Reijiro; Ojima, Shuichi; Paul, S.K. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Dec 1988. 10p. Order Number DE89790891/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

Relations between Virasoro algebra and Krichever-Novikov (KN) algebra are investigated on a torus. Generators of the KN algebra are shown to be expressed by linear combinations of those of the Virasoro algebra. We also study the current algebra, which allows us to define the Krichever-Novikov-Kac-Moody (KNKM) algebra on the torus.

37557 (RRK–89-5) **Perturbation of c=1 conformal field theory and quantum sine-Gordon theory.** Yoshii, Hisahiro. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Jan 1989. 10p. Order Number DE89790894/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

We study the relevant perturbation of gaussian c = 1 conformal field theories. The unitary minimal conformal models are derived from c = 1 rational gaussian models compactified on the circle and the Z_2 orbifold with a suitable radius. There is one-to-one correspondence between the compactification radius and the minimal model. We also discuss the connection of the conformal theory with quantum sine-Gordon theory.

37558 **Stable static solitons in the nonlinear sigma model with a topological term.** Voruganti, P. (Stanford Linear Accelerator Center, CA (USA)). *Physics Letters [Section] B (Netherlands)*, 223(2): 181-186 (8 Jun 1989). DOE Contract AC03-76SF00515.

Soliton solutions in the nonlinear sigma model in (2+1) space-time dimensions are analyzed classically in the presence of the Chern-Simons term using a CP^1 map. Making an expansion in θ_{CP}, the new contributions to the energy functional push the solitons to infinite size. It is further shown that including quantum zero-point fluctuations around the soliton vacuum in the long-wavelength limit is insufficient to stabilize its size.

37559 **Using reparametrization invariance to define vacuum infinities in string path integrals.** Callan, C.G. (Stanford Linear Accelerator Center, CA (USA)); Thorlacius, L. *Nuclear Physics [Section] B (Netherlands)*, 319(1): 133-154 (5 Jun 1989). DOE Contract AC03-76SF00515.

Path integrals for interacting world sheet sigma models play a key role in string theory. For open strings, the relevant path integral is one-dimensional and has direct physical interpretation as a source term for closed string fields. This means that the vacuum divergences (Moebius infinities) of the path integral must be renormalized correctly. In this paper we show that reparametrization invariance Ward identities, apart from specifying the equations of motion of space-time background gauge fields, also serve to fix the renormalization scheme of the vacuum divergences.

65 PHYSICS II

Refer also to citation(s) 37418, 37419, 37420, 37678

6510 Nuclear Physics

Refer also to citation(s) 37031, 37032, 37110, 37502

37560 (ANL/NDM–111) **Fifty years of nuclear fission: Nuclear data and measurements series.** Lynn, J.E. Argonne National Lab., IL (USA). Jun 1989. 22p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE89014084/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report is the written version of a colloquium first presented at Argonne National Laboratory in January 1989. The paper begins with an historical preamble about the events leading to the discovery of nuclear fission. This leads naturally to an account of early results and understanding of the fission phenomena. Some of the key concepts in the development of fission theory are then discussed. The main theme of this discussion is the topography of the fission barrier, in which the interplay of the liquid-drop model and nucleon shell effects lead to a wide range of fascinating phenomena encompassing metastable isomers, intermediate-structure effects in fission cross-sections, and large changes in fission product properties. It is shown how study of these changing effects and theoretical calculations of the potential energy of the deformed nucleus have led to broad qualitative understanding of the nature of the fission process. 54 refs., 35 figs.

37561 (CNEA-NT–3/88) **Nuclear physics workshop.** Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1988. 291p. (In Spanish, English, Portugue (CONF-8706396–: 10. nuclear physics workshop, Buenos Aires, Argentina, 23-26 Jun 1987). Order Number DE89620459/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

This Workshop in Nuclear Physics related to the TANDAR, took place in Buenos Aires in April from 23 to 26, 1987, with attendance of foreign scientists. There were presented four seminars and a lot of studies which deal with the following fields: Nuclear Physics at medium energies, Nuclear Structure, Nuclear Reactions, Nuclear Matter, Instrumentation and Methodology for Nuclear Spectroscopy, Classical Physics, Quantum Mechanics and Field Theory. It must be emphasized that the Electrostatic Accelerator TANDAR allows to work with heavy ions of high energy, that opens a new field of work in PIXE (particle induced X-ray emission). This powerful analytic technique makes it possiblethe analysis of nearly all the elements of the periodic table with the same accuracy. (M.E.L.).

37562 (CONF-8903132–3) **Transverse energy scaling and energy density estimates from ^{16}O- and ^{32}S-induced reactions.** Awes, T.C.; Albrecht, R.; Baktash, C.; Beckmann, P.; Berger, F.; Bock, R.; Claesson, G.; Clewing, G.; Dragon, L.; Eklund, A. WA80 Collaboration. Oak Ridge National Lab., TN (USA). 1989. 6p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 24. Rencontres de Moriond: electroweak interactions and unified theories; Les Arcs, France; 5-12 Mar 1989. Order Number DE89013007/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We discuss the dependence of transverse energy production on projectile mass, target mass, and on the impact parameter of the heavy ion reaction. The transverse energy is shown to scale with the number of participating nucleons. Various methods to estimate the attained energy density from the observed transverse energy are discussed. It is shown that the systematics of the energy density estimates suggest average of 2-3 GeV/fm^3 rather than the

much higher values attained by assuming Landau-stopping initial conditions. Based on the observed scaling of the transverse energy, an initial energy density profile may be estimated. 11 refs., 4 figs.

37563 (DOE/ER/40002–T1) **Research in nuclear physics at low and intermediate energies, neutrinos and x rays: Final report, May 1980–August 1987.** California Inst. of Tech., Pasadena, CA (USA). 1987. 161p. Sponsored by DOE Energy Research. DOE Contract AS03-81ER40002. Order Number DE89012698/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

During the past year the research in our West Bridge Laboratory at Caltech has continued to focus on studies of neutrino properties, particularly neutrino mass. To this end the nuclear double beta decay has been exploited and several experiments have been carried out. Upon completion of a series of comprehensive studies of backgrounds and radioactive impurities in various materials conducted with a 90 cm^2 Ge detector in our Gotthard tunnel laboratory, a large 8 crystal Ge detector array with its cryostat, copper and lead shielding, and data acquisition computer has been installed in the Gotthard tunnel and is now operating well with the anticipated low background. Sensitive limits for two-neutrino and neutrinoless decay, as well as for majoron emission have already been obtained. The latter results rule out a recently published claim. The design and construction of the xenon time projection chamber has been completed. The TPC now operated with an active volume of 206 liters of xenon gas 5 atm. At the present time electron and muon tracks are being recorded and analyzed using a computer based pattern recognition scheme. A double beta decay event is recognized by a contiguous track beginning and ending with a high ionization density "blob". At the same time, theoretical nuclear structure calculations have been conducted to help evaluate the rates of the two-neutrino and neutrinoless processes in various double beta decay candidates, including the nuclei ^{76}Ge and ^{136}Xe. To further explore new techniques capable of identifying double beta decay in high density targets, extensive studies of electron-ion pair recombination in liquid argon and liquid xenon have been conducted, leading to several novel concepts for the creation of the electron track and the observed energy resolution.

37564 (DOE/ER/40004–T2) **Medium energy meson physics: [Progress report, 1981–1983].** Crowe, K.M. California Univ., Berkeley, CA (USA). Dept. of Physics. 1 Aug 1983. 13p. Sponsored by DOE Energy Research. DOE Contract AS03-81ER40004. Order Number DE89014557/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper discusses with gamma ray pair spectrometer measurements of radiative pion capture reactions, weak interaction using muon decay parameters and properties of muonium.

37565 (DOE/ER/40004–T4) **Medium energy meson physics: Progress report, January 1, 1986 through December 31, 1986.** Crowe, K.M. California Univ., Berkeley, CA (USA). Dept. of Physics. 1986. 19p. Sponsored by DOE Energy Research. DOE Contract AS03-81ER40004. Order Number DE89014562/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper discusses pion bremsstrahlung radiation reactions; eta resonances; π^+/π^- elastic scattering on ^3He and ^4He; muon catalyzed fusion; and μSR. (LSP)

37566 (DOE/ER/40150–73) **CEBAF/SURA [Continuous Electron Beam Accelerator Facility]/[Southeastern Universities Research Association] 1988 summer workshop: Proceedings.** Gross, F.; Lightbody, J. (eds.). Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility. Jan 1989. 396p. Sponsored by DOE Energy Research. DOE Contract AC05-84ER40150. (CONF-880688–: Summer workshop of the continuous electron beam accelerator facility, Newport News, VA, USA, 20-24 Jun 1988). Order Number DE89014427/JAW. Available from NTIS, PC A17/MF A01 - OSTI; GPO Dep.

This report contains papers from a summer workshop of the continuous electron beam accelerator facility. Some topics of these papers are: spectrometers; electron scattering from deuterons; relativistic correlations in nuclear matter; pion production on ^3He and ^3H; quantum electrodynamic processes in crystals; $^{12}C(e,e'p)$ x reaction; deuteron polarization tensor and relativistic spin rotation; electromagnetic excitation of nuclei; electron distortion and structure functions in (e,e'p) reactions; and reaction mechanism of $^4He(e,e'p)^3H$. (LSP)

37567 (DOE/ER/40150–75) **CEBAF/SURA [Continuous Electron Beam Accelerator Facility]/[Southeastern Universities Research Association] 1987 summer workshop: Proceedings.** Gross, F.; Williamson, C. (eds.). Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility. Oct 1987. 483p. Sponsored by DOE Energy Research. DOE Contract AC05-84ER40150. (CONF-8706200–: CEBAF summer workshop, Newport News, VA, USA, 22-26 Jun 1987). Order Number DE89014430/JAW. Available from NTIS, PC A21/MF A01 - OSTI; GPO Dep.

This report contains papers from the CEBAF accelerator facility summer workshop. Some topics covered are: baryon-baryon interactions, deuteron form factors; neutron detection; high resolution spectrometers; nuclear strangeness; parity violation; photon-deuteron interactions; chemical reactions in ion sources; quantum chromodynamics; hypernuclear magnetic moments; and photoproduction of π^+ from ^{14}N. (LSP)

37568 (DOE/ER/40150–78) **HUGS at CEBAF [Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility] June 6–24, 1988: Proceedings.** Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility. 1988. 222p. Sponsored by DOE Energy Research. DOE Contract AC05-84ER40150. (CONF-8806381–: 3. annual Hampton University Graduate Studies (HUGS) summer school, Newport News, VA, USA, 6-24 Jun 1988). Order Number DE89014426/JAW. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

Topics discussed in this paper are: Physics thru the last 80 years; low energy neutron physics at LAMPF; experiments on P-violation; nucleon structure structure and nucleon resonances; electro-excitation of nucleon resonances; electron scattering (e,e'p) experiments; quasielastic scattering of electron with nucleus (introduction to (e,e'P) experiment); CEBAF's machine; quantum hadrodynamics-QHD-1 the Walecka model; relativistic nuclear dynamics; hybrid models and QCD; and modeling confinement: poor man's version.

37569 (DOE/ER/40150–81) **CEBAF/SURA 1986 summer workshop: Proceedings.** Gross, F.; Minehart, R. (eds.). Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility. Nov 1986. 706p. Sponsored by DOE Energy Research. DOE Contract AC05-84ER40150. (CONF-8606241–: 3. Continuous Electron Beam Accelerator Facility summer school, Newport News, VA, USA, 23-27 Jun 1986). Order Number DE89014423/JAW. Available from NTIS, PC A99/MF A01 - OSTI; GPO Dep.

The organization of this volume parallels the program of the 1986 Workshop; it consists of summary talks on the status of CEBAF, invited talks on theoretical and experimental subjects related to the CEBAF program, and working group meetings. The summary talks published here have been revised to include developments subsequent to the Workshop. Some topics discussed by the invited talks are: from the standard model to superstrings; quark models of nucleons and nuclei; multiparticle final states from pion-induced reactions; proton electromagnetic form factors; excited baryons; generating the bag with glueballs; deuteron polarimeters at intermediate energies; nuclear effect in deep-inelastic lepton-nucleus scattering; and delta electron- and photo-production in nuclei.

37570 (DOE/ER/40323–T1) **[Medium energy meson research]: [Progress report].** Crowe, K.M. California Univ., Berkeley, CA (USA). Dept. of Physics. [1989]. 24p. Sponsored by DOE Energy Research. DOE Contract FG03-87ER40323. Order Number DE89014123/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this section, we will provide an overview of the research program of this group. The major activity in 1988 has been in connection with the Crystal Barrel experiment, PS No. 197, at CERN, using the LEAR facility. We will review the motivation of the experiment, the overall progress of the construction of the apparatus and

the current schedule. In a separate section, we will present a detailed account of the Berkeley contribution, the central Jet Drift Chamber (JDC), the prototype study and the results of our progress to date. We will present a short section in which the other research programs which are being completed will be summarized, together with the accomplishments for 1988. Finally, we will discuss the program for 1989 as we bring together all the Crystal Barrel apparatus at LEAR to begin the experimental program.

37571 (LAL–87-10) **Radiative decay of J/psi into $\gamma\pi^+\pi^-$.** Augustin, J.E.; Cosme, G.; Couchot, F. and others; DM2 Collaboration. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Apr 1987. 16p. Order Number DE89789228/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The radiative decay J/psi -> $\gamma\pi^+\pi^-$ has been studied using the 8.6 million J/psi produced in the DM2 experiment at the DCI e^+e^- storage rings at Orsay. The $\pi^+\pi^-$ mass spectrum shows a clean $f_2(1270)$ signal, and the possible presence of two other states at the $f_2(1720)$ and $f_4(2030)$ masses. For the $f_2(1270)$, the branching ratio BR(J/psi -> γf) x BF(f -> $\pi^+\pi^-$) is measured to be (7.50 $\pm$ 0.30 $\pm$ 1.12) x 10^{-4}, and the spin analysis prefers the J=2 assignment, with helicity parameters x = 0.83 $\pm$ 0.06 and y = 0.01 $\pm$ 0.06. The existence of higher mass states is discussed.

6511 Experimental Techniques

37572 (CONF-8901115–3) **Development of a polarized deuterium target to measure T_{20} in electron storage rings.** Young, L.; Coulter, K.; Gilman, R.A.; Holt, R.J.; Kinney, E.R.; Kowalczyk, R.S.; Napolitano, J.; Potterveld, D.; Lasarenko, B.A.; Mishnev, S.I. Argonne National Lab., IL (USA). 1989. 7p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Topical conference on electronuclear physics with internal targets; Stanford, California, USA; 9-12 Jan 1989. Order Number DE89014632/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The development of a polarized deuterium target to measure the analyzing power in electron scattering from the deuteron at the highest possible momentum transfer is described. Two areas of research have been simultaneously pursued: the development of a storage cell for polarized atoms (ANL and INP) and the development of a high-flux laser-driven source of polarized deuterium (ANL). The successful combination of these two technological developments will produce a polarized target having a figure of merit of $np_{zz}^2 \approx np_z^2 \approx 10^{14}$ cm^{-2}. The progress to date, including, feasibility tests of the storage cell concept, design of a high-density storage cell ad the development of the laser-driven source will be described. 14 refs., 7 figs.

37573 (IPNO-DRE–88-24) **Interaction of 20-100 MeV/u heavy ions with cold matter.** Herault, J.; Bimbot, R.; Gauvin, H.; Anne, R.; Bastin, G.; Hubert, F. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1988. 10p. (CONF-8806104–: International workshop on atomic physics for ion driven fusion, Orsay, France, 20-24 Jun 1988). Order Number DE89789265/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

The stopping powers of 12 solids and 10 gases and the associated energy loss straggling have been measured at GANIL for $^{16O-17}O$, ^{40}Ar, ^{40}Ca, ^{84}Kr-^{86}Kr, ^{100}Mo and ^{129}Xe-^{132}Xe ions in the energy domain 24 to 95 MeV/u. After a brief description of the experimental method, the set of data are presented and discussed. As far as stopping powers are concerned, a scaling law in Z_p^2 relative to the ^4He stopping powers at the same velocity becomes applicable when the projectile tends to be fully stripped. At the same time, the solid-gas effect, observed at low energy, vanishes. The energy loss straggling is compared to that deduced from Bohr model and some of its refinements. The theoretical value appears to be too small, by a factor 2, when the projectile is fully stripped. For partially stripped ions, the charge exchange straggling might explain the experimental observation.

37574 (IPNO-DRE–88-37) **Production of 400 MeV/u radioactive ion beams for therapy purposes.** Bimbot, R. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1988. 24p. (CONF-8811152–: EULIMA workshop on the potential value of light ion beam therapy, Nice, France, 3-5 Nov 1988). Order Number DE89781599/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The production of radioactive beams from 400 MeV/u light ions (^{12}C-^{20}Ne) fragmentation is studied. The characteristics of these beams (energy, energy width, angular width) are calculated from the nuclear reaction kinematics, and from the modifications induced by ion-target interaction. The method used to select and purify such beams is given, and the main characteristics of the beam line (spectrometer) to be used are defined. Finally the production rates are derived from the available fragmentation cross sections.

6512 Nuclear Properties and Reactions, A=1-5, Experimental

Refer also to citation(s) 37506, 37508, 37610

37575 (LAL–87-35) **Measurement of the decays K_L -> 2γ and K_S -> 2γ.** Lutz, A.M. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. May 1987. 11p. (CONF-8703319–: Moriond meeting on progress in electroweak interactions, Les Arcs, France, 8 Mar 1987). Order Number DE89789227/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Using the Na31 set-up at the CERN SPS we have measured the decays K_L -> 2γ and K_S -> 2γ. The results are $\Gamma(K_L \to 2\gamma)/\Gamma(K_L \to 2\pi^0)$ = 0.632 $\pm$ 0.004 $\pm$ 0.008 and $\Gamma(K_S \to 2\gamma)/\Gamma(K_L \to 2\gamma)$ = 2.3 $\pm$ 1.0 $\pm$ 0.4. This is the first observation of K_S -> 2γ decays.

6513 Nuclear Properties and Reactions, A=6-19, Experimental

Refer also to citation(s) 37630

37576 (CRN-PN–8811) **Origin of the ^{13}C + ^{17}O resonant structure.** Freeman, R.M.; Basrak, Z.; Haas, F.; Hachem, A.; Monnehan, G.A.; Morsad, A.; Youlal, M. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France). 1988. 7p. Order Number DE89789272/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

Using particle techniques we have been unable to reproduce the resonant structure in the inelastic channel of the ^{13}C + ^{17}O reaction. The structure previously observed in the γ-ray yields for the 0.871-MeV transition is now believed to be due to a hydrogen contamination.

37577 (FRCEA-TH–158) **Measure of back angle cross sections of antiproton-nucleus elastic scattering at 48 and 180 MeV.** Berrada, M. Grenoble-1 Univ., 38 (France); CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale. Apr 1986. 129p. (In French). Order Number DE89789210/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

Antiproton-nucleus elastic scattering was studied in the LEAR ring at CERN. The scattering cross section at back angles (θ LAB = 142 to 164 deg inclusive) was measured using plastic scintillation detectors. Analysis of experimental data at 47 MeV for a CH target and at 182 MeV for CH, C12, 016, and 018 targets produces differential cross sections for back angles less than or equal to a few dozen microbarns. These results agree with theoretical microscopic predictions. The analysis improves understanding of antiproton-nucleus interaction and introduces a constraint on the construction of optical potentials. The antiproton-nucleus potential is shown to be highly absorbing, thereby excluding S type potentials, and removing the ambiguity arising from the analysis of antiprotonic atoms. The results also show that there is no attractive pocket in the real potential likely to lead to an increase of the back angle cross sections.

37578 (IPNO-DRE–88-05) **Fusion-fission of heavy systems: influence of the entrance channel mass asymmetry.** Rivet, M.F.; Alami, R.; Borderie, B.; Fuchs, H.; Gardes, D.; Gauvin, H. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Feb 1988. 26p. Order Number DE89781491/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The influence of the entrance channel on fission processes was studied by forming the same composite system by two different target-projectile combinations (^{40}Ar + ^{209}Bi and ^{56}Fe + ^{187}Re,

respectively). Compound nucleus fission and quasi fission were observed and the analysis was performed in the framework of the extra-extra-push model, which provides a qualitative interpretation of the results; limits for the extra-extra-push threshold are given, but problems with quantitative predictions for the extra-push are noted.

37579 **^{7}Li(p,n)^{7}Be and ^{12}C(p,n)^{12}N reactions at 200, 300, and 400 MeV.** Watson, J. W. (Department of Physics, Kent State University, Kent, Ohio 44242 TRIUMF, Vancouver, British Columbia, Canada V6T 2A3 Department of Physics, University of Western Ontario, London, Ontario, Canada N6A 3K7 Department of Physics, Simon Fraser Univ *Physical Review [Section] C: Nuclear Physics (USA)*, 40(1): 22-26 (Jul 1989).

At 200, 300, and 400 MeV bombarding energies, we measured cross sectionangular distributions for the^{7}Li(p,n)^{7}Be(g.s.+0.43 MeV)reaction and 0° cross sections for the^{12}C(p,n)^{12}N(g.s.) reaction. Systematicsof these reactions are presented. The center-of-mass cross section for the^{7}Li(p,n)^{7}Be(g.s.+0.43 MeV)reaction, when plotted as a function of momentum transfer, is nearlyindependent of energy. The laboratory cross section for this reaction at 0°in the energy range from 60 to 400 MeV is also independent of energy, having aconstant value, to within experimental errors, of 35.5 mb/sr with an estimateduncertainty of ±1.5 mb/sr.

6514 Nuclear Properties and Reactions, A=20-38, Experimental

Refer also to citation(s) 37578, 37596

37580 (CRN-PN–8620) **Transition between phenomena governed by the mean field and those governed by nucleon-nucleon collisions in the reaction ^{40} Ar + ^{68} Zn.** Fahli, A. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 1986. 112p. (In French). Order Number DE89776429/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

Collisions between a Zn target and Ar of 14.6, 19.6, 27.6 and 35 MeV/nucleon incident energy cover part of the transition region between reaction mechanisms dominated by the mean field observed at low energy and those resulting from nucleon-nucleon interaction at high energy. Peripheral collisions in this reaction have been studied. Experimental energy spectra for ejectiles having nearly the projectile mass, have been reproduced using diffractional model calculations. The competition between fragmentation and transfer processes in the production of projectile-like fragments shows the persistance of collective effects. The heavy fragments emitted in central collisions have also been investigated. Fusion-evaporation and fusion-fission cross sections have been measured. Incomplete fusion is present at all the incident energies and becomes increasingly preponderant over complete fusion with increasing projectile energy. From comparison with other results, the momentum transfer appears to depend on the asymmetry of the system and on the projectile mass. Fusion disappears slightly above 35 MeV/nucleon which corresponds to a compound nucleus temperature of about 7 MeV. The characteristics of the charged light particles emitted in the reaction have been studied, and analyzed with several models: moving source, preequilibrium emission and coalescence model.

6515 Nuclear Properties and Reactions, A=39-58, Experimental

37581 (ISN–87-87) **Decay of new mass-separated neutron-deficient La and Ce isotopes.** Genevey, J.; Gizon, A.; Idrissi, N.; Weiss, B.; Beraud, R.; Charvet, A.; Duffait, R.; Emsallem, A.; Meyer, M.; Ollivier, T. Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires. 1987. 6p. (CONF-8709440–: 5. International conference on nuclei far from stability, Rosseau Lake, CA, USA, 14-19 Sep 1987). Order Number DE89781514/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

By use of a He jet system coupled to a Bernas-Nier ion-source, several new mass-separated A = 122 - 127 isotopes reached in heavy ion fusion reactions at SARA have been identified and studied. From experimental decay properties of La isotopes, systematics of low-lying energy levels have been extended for even-even and odd-A barium. New informations on Ce decay schemes are briefly reported.

6516 Nuclear Properties and Reactions, A=59-89, Experimental

Refer also to citation(s) 37596

37582 (AD-A–205221/5/XAB) **Gamma-ray-laser pump diagnostic. Final report.** Collins, C.B. General Coherent Technology, Inc., Richardson, TX (USA). 18 Jan 1989. 80p. Available from NTIS, PC A05/MF A01.

The nuclear analog of the ruby laser would embody the most straightforward of the several concepts for a gamma-ray laser. The greatest progress toward an ultrashort-wavelength laser has been achieved along that direction. For ruby the identification and exploitation of a bandwidth funnel were the critical keys in the development of the first laser. There was a broad absorption band linked through efficient cascading to the narrow laser level. The search for the analogous situation on the nuclear scale is proceeding quite fruitfully. Significant amounts of nuclear fluorescence have been pumped by pulsed bremsstrahlung sources; thus proving that the concept of bandwidth funneling works as well at the nuclear level as it does for the ruby. This critical process was found to produce eleven orders of magnitude increase in the amount of X-ray pump energy absorbed into demonstration nuclei of Se 77. Most recently, the first of the 29 candidate materials for a gamma-ray laser was successfully pumped with intense pulses of bremsstrahlung. The yield of nuclear fluorescence was about 10,000 times greater than what was predicted, including the large factor for funneling. Selected over 28 alternatives solely on the basis of availability, this first material narrowly missed the threshold of feasibility for a gamma-ray laser. These results with a relatively unattractive candidate indicate that the probabilities should be raised for full success of one of the other 28 materials.

37583 (DOE/ER/40481–2) **Measurement of solar proton-proton fusion neutrinos with a Soviet-American gallium experiment: Technical progress report.** Cherry, M.L. Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Physics and Astronomy. Jun 1989. 6p. Sponsored by DOE Energy Research. DOE Contract FG05-88ER40481. Order Number DE89014563/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A gallium solar neutrino detector is sensitive to low-energy proton-proton fusion neutrinos. A flux of 70 SNU is expected in a gallium detector from the p-p reaction independent of solar model calculations. If, however, neutrino oscillations in the solar interior are responsible for the suppressed ^{8}B flux measured by the Homestake ^{37}Cl experiment, then a comparison of the gallium and chlorine results may make possible a determination of the neutrino mass difference and mixing angle. A 60-ton gallium detector is currently being constructed in the Baksan Laboratory in the Soviet Union, and should be taking data by the end of 1989.

37584 (INIS-mf–11396, pp. 82) **Lifetime of the O_2^+ state of ^{72}Ge.** Prozesky, V.M. (Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria (South Africa)); Mingay, D.W. South African Inst. of Physics, Faure (South Africa). 1987. (In Afrikaans). (CONF-8707216–: 32. Annual conference of the South African Institute of Physics, Durban, South Africa, 13-17 Jul 1987). In *32nd Annual conference and the 22nd annual theoretical seminar of the South African Institute of Physics.* Order Number DE89615754/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

This publication contains only the abstracts of seminars.

GERMANIUM 72/kev range 100-1000; GERMANIUM 72/lifetime; LIFETIME; RADIATION DETECTORS

6517 Nuclear Properties and Reactions, A=90-149, Experimental

37585 (ANL/NDM–112) **Some remarks on the neutron elastic- and enelastic-scattering cross sections of palladium.** Chiba, S.; Guenther, P.T.; Smith, A.B. Argonne National Lab., IL (USA). May 1989. 15p. Sponsored by DOE Nuclear Energy. DOE

Contract W-31109-ENG-38. Order Number DE89014105/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The cross sections for the elastic-scattering of 5.9, 7.1 and 8.0 MeV neutrons from elemental palladium were measured at forty scattering angles distributed between ≈15° and 160°. The inelastic-scattering cross sections for the excitation of palladium levels at energies of 260 keV to 560 keV were measured with high resolution at the same energies, and at a scattering angle of 80°. The experimental results were combined with lower-energy values previously obtained by this group to provide a comprehensive data base extending from near the inelastic-scattering threshold to 8 MeV. That data base was interpreted in terms of a coupled-channel model, including the inelastic excitation of one- and two-phonon vibrational levels of the even isotopes of palladium. It was concluded that the palladium inelastic-scattering cross section, at the low energies of interest in assessment of fast-fission-reactor performance, are large (≈50% greater than given in widely used evaluated fission-product data files). They primarily involve compound-nucleus processes, with only a small direct-reaction component attributable to the excitation of the one-phonon, 2^+, vibrational levels of the even isotopes of palladium. 24 refs., 6 figs.

37586 (CRN-PN–88-02) **Neutron emission and nuclear spin distribution in 4n and 5n exit channels of the ^{156}Dy compound nucleus.** Vivien, J.P.; Benet, P.; Beck, F.A.; Byrski, T.; Curien, D.; Duchene, G.; Gehringer, C.; Haas, B.; Merdinger, J.C.; Bozek, E. and others. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 1988. 14p. (CONF-880195–: 26. international winter meeting on nuclear physics, Bormio, Italy, 25-29 Jan 1988). Order Number DE89789273/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Experiments performed at the Chateau de cristal facility were undertaken to study the $^{32}S + ^{124}Sn \rightarrow ^{156}Dy$ fusion reaction at compound nucleus excitation energies of 59, 65 and 74 MeV. By tagging on the different isomers, neutron energies for the 4n and 5n exit channels have been studied by time of flight techniques. The corresponding nuclear spin distributions for the 4n and 5n channels have also been deduced from the γ-multiplicity distributions. Average nuclear temperatures, extracted from the neutron spectra, differ appreciably from those deduced from the measured total energy released by the γ-ray cascade.

37587 (CRN-PN–8513) **Fast-fission component with small mass drift in the reaction $^{84}Kr + ^{27}Al$ at E_{Lab} = 5.9 MeV/u.** Heusch, B.; Freiesleben, H.; Schneider, W.F.W.; Kohlmeyer, B.; Stege, H.; Puehlhofer, F. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 1985. 20p. Order Number DE89789226/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

All reaction products in the range from target- and projectile-like to fission-like fragments were measured for the system $^{84}Kr + ^{27}Al$ at 5.9 MeV/u beam energy. They are assigned to the various reaction mechanisms on the basis of experimental signatures (energy dissipation, mass and angular distribution). The sum of the measured partial cross sections, including the evaporation residue yield obtained previously, agrees with the total reaction cross section derived from elastic scattering. A small fast-fission component was found, discernible from deep-inelastic reactions by its $1/\sin\theta$ angular distribution, and distinguished from compound-nucleus fission by an incomplete mass asymmetry relaxation.

37588 (IPNO-DRE–88-01) **Selective population of the highest spin n-p states in heavy nuclei via the (α, d) reaction at 218 MeV.** Langevin-Joliot, H.; Datar, V.; Gerlic, E.; Van de Wiele, J.; Azaiez, F.; Fortier, S.; Gales, S.; Guillot, J.; Maison, J.M.; Duhamel, G. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1988. 13p. Order Number DE89789267/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Strong transitions to high spin states are observed in the study of the (α,d) reaction at 218 MeV on closed shell heavy nuclei. It is shown that the highest spin valence valence n-p strength in the residual nuclei ^{92}Nb, ^{122}Sb, ^{146}Eu and ^{210}Bi is shared between a first strongly excited fragment and higher lying groups. The valence + outer shell $(vi_{13}2/x\ \pi h_{11}2/)_{12}^-$ strength is tentatively identified in ^{122}Sb.

37589 (ISN–87-88) **Low-spin states in ^{122}Cs.** Weiss, B.; Gizon, A.; Liang, C.F.; Paris, P.; Isocele Collaboration. Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires. 1987. 4p. (CONF-8709440–: 5. International conference on nuclei far from stability, Rosseau Lake, CA, USA, 14-19 Sep 1987). Order Number DE89781515/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

The decay of ^{122}Ba to the odd-odd ^{122}Cs levels has been studied with on-line mass-separated samples at the Isocele facility. A complex level scheme including 42 new low-spin excited states has been established using gamma and conversion electron spectroscopy techniques. From a series of new measurements, the T1/2 = 0.36s ^{122}Cs isomeric state is proposed at 127 keV with 5^- spin and parity assignments.

37590 **Magnetic moments of low-lying states in ^{103}Rh, ^{111,113}Cd, and ^{123,125}Te.** Benczer-Koller, N. (Department of Physics, Rutgers University, New Brunswick, New Jersey 08903(US)); Lenner, G.; Tanczyn, R.; Pakou, A.; Kumbartzki, G.; Pique, A.; Barker, D.; Berdichevsky, D.; Zamick, L. *Physical Review [Section] C: Nuclear Physics (USA)*, 40(1): 77-90 (Jul 1989).

The magnetic moments of several short-lived states in ^{103}Rh, ^{111,113}Cd, and ^{123,125}Te isotopes have been measured by the transient field technique. The results, together with those obtained earlier in the ^{107,109}Ag isotopes, have been compared to predictions of various models and calculations. In the Z=45,47 isotopes, the odd proton seems to deform the vibrational core. The data are best explained within the framework of a triaxially deformed nucleus. In the odd-neutron isotopes with $50<N<82$ and Z=48,52, weak-coupling states coexist with single-particle states in a mix of configurations.

6518 Nuclear Properties and Reactions, A=150-189, Experimental

Refer also to citation(s) 37606

37591 (IPNO-DRE–88-02) **Collective structures in ^{185}Hg.** Bourgeois, C.; Hildingsson, L.; Perrin, N.; Sergolle, H.; Hannachi, F.; Bastin, G.; Porquet, M.G.; Thibaud, J.P.; Beck, F.A.; Merdinger, J.C. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1988. 22p. Order Number DE89789264/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Excited states of ^{185}Hg have been investigated via the ^{161}Dy (^{28}Si, 4n) reaction at 145 MeV. In-beam gamma-ray spectroscopy studies have been performed with the "Chateau de Cristal" 4π-multidetector array. Level scheme of ^{185}Hg has been established. Shape coexistence, still present in ^{185}Hg like in the neighbouring Hg isotopes, manifests itself through a weakly populated decoupled band built on the 13/2+ isomer and three strongly-coupled bands built on the prolate 1/2-[521], 7/2-[514], and 9/2+[624] Nilsson states.

37592 (IPNO-DRE–88-31) **Shape transition in neutron deficient PT isotopes.** Le Blanc, F.; Kilcher, P.; Obert, J.; Oms, J.; Putaux, J.C.; Duong, H.T.; Pinard, J.; Liberman, S.; Savard, G.; Lee, J.K.P.; ISOCELE Collaboration. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1988. 13p. Order Number DE89789268/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Isotope shift (IS) and hyperfine structure (HFS) measurements have been performed for ^{185}Pt, ^{187}Pt, ^{189}Pt, ^{191}Pt, ^{195}Pt using the PILIS (Post ISOCELE Laser Isobar Separation) apparatus installed at the ISOCELE facility. Magnetic and quadrupole moments have been deduced from the HFS results. The charge radius changes determined for these odd nuclei from the IS results, added to the $\delta \langle r^2 \rangle$ values of the even-A nuclei are compared to the results of lattice Hartree-Fock+BCS calculations for asymmetric solutions. ^{185}Pt is confirmed to be prolate shaped whereas ^{187}Pt, ^{189}Pt, ^{191}Pt are likely triaxial in their ground states.

37593 (IPNO-DRE–88-33) **Shape coexistence at high spin in ^{187}Au.** Bourgeois, C.; Perrin, N.; Sergolle, H.; Porquet, M.G.; Hannachi, F.; Bastin, G.; Beck, F. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1988. 29p. Order Number DE89789269/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

High-spin states in ^{187}Au have been populated in the ^{172}Yb(^{19}F, 4n) reaction and studied with in-beam spectroscopic techniques using the "Chateau de Cristal" 4π-multidetector array. A comprehensive level scheme of ^{187}Au has been established. Experimental band crossing frequencies and gains in alignment were deduced. Shape coexistence in ^{187}Au, well established at low spin, is found to survive up to spin 57/2, and manifests itself through well separated oblate and prolate structures.

37594 (IPNO-DRE–88-34) **Decay of doubly-odd nucleus ^{184}Ir.** Kilcher, P.; Roussiere, B.; Sauvage, J.; Bourgeois, C.; Porquet, M.G.; Dautet, H.; Lee, J.K.P.; ISOCELE Collaboration. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1988. 29p. Order Number DE89789266/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The ^{184}Ir β^+, EC decay has been investigated using the ISOCELE facility. A detailed ^{184}Os level scheme has been obtained. Spin and parity assignments have been deduced from transition multipolarities. The $Q_{\beta+}$ value has been measured to be 3260 $\pm$ 70 keV by means of a solid-state ΔE-E telescope and logft values have been calculated for the levels which are the most clearly fed. Two highly converted transitions have been pointed out. Contrary to results previously reported, the ground-state band of ^{184}Os is not directly populated. It is concluded that the ^{184}Ir ground state has spin and parity value $I^{\pi} = 4^-$ or 5^- with projection value K which may be 4 and/or 5. The ^{184}Os levels are compared to those of the other osmium isotopes and the structure of the 3_1^- level is discussed.

37595 (LA-UR–89-1649) **Particle production results from HELIOS.** Jacak, B. Los Alamos National Lab., NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8905163–1: 3. conference on intersections between particle and nuclear physics, Rockport, ME, USA, 14-19 May 1989). Order Number DE89013454/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper shows that global variables such as transverse energy and multiplicity can be used to characterize events according to impact parameter. E_t and multiplicity show a linear relationship, indicating that higher E_t arises from production of more particles rather than a large change in the particle spectra. The shapes of the distributions can be explained by superposition of nucleon-nucleon scattering. There is no large difference among the observed charged particle spectra from p + W, O + W, and S + W. We observe no sharp rise in $\langle p_t \rangle$ vs E_t, but it must be noted that the detected $_{pt}$ spectrum is affected by the hadronization process and reflects conditions at the time of freezeout of hadrons. Also, an increase in the cross section for large pt is expected from hard scattering of partons and does not necessarily indicate more exotic processes. 10 refs., 6 figs.

6519 Nuclear Properties and Reactions, A=190-219, Experimental

Refer also to citation(s) 37588, 37592, 37606

37596 (BNL–42803) **Survey of results from Brookhaven Experiment 802 at the AGS.** Abbott, T.; Akiba, Y.; Alburger, D.; Beavis, D.; Bloomer, M.A.; Bond, P.D.; Chasman, C.; Chen, Z.; Chu, Y.Y.; Cole, B.A. Brookhaven National Lab., Upton, NY (USA). 1989. 10p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8904153–4: Symposium on nuclear dynamics and nuclear disassembly, Dallas, TX, USA, 9-14 Apr 1989). Order Number DE89014190/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Brookhaven Experiment 802 (E-802) is a magnetic spectrometer experiment which is directed toward the measurement of particle momentum spectra and particle-particle correlations following reactions with 14.5 GeV/u O and Si ions. In addition to the spectrometer there are detectors to measure the transverse energy flow, longitudinal energy flow, and the multiplicity. These detectors can be used to characterize the particle spectra or correlated between themselves. Particle spectra have been obtained for protons, pions, and kaons using targets of gold, copper, and aluminum although the data are not entirely analyzed as yet. A first result that is of interest is the K^+/π^+ ratio for Si + Au reactions which is larger than expected on the basis of the known p + p data. 4 refs., 11 figs.

37597 (CONF-8904153–3) **Attained energy densities and neutral pion spectra in nucleus-nucleus collisions at 200 GeV/nucleon.** Plasil, F.; Albrecht, R.; Awes, T.C.; Baktash, C.; Beckmann, P.; Berger, F.; Bock, R.; Claesson, G.; Clewing, G.; Dragon, L. WA80 Collaboration. Oak Ridge National Lab., TN (USA). 1989. 12p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From Symposium on nuclear dynamics and nuclear disassembly; Dallas, Texas, USA; 9-14 Apr 1989. Order Number DE89013536/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The main goal of the CERN heavy-ion experiments is the search for an indication that the predicted state of deconfined quarks and gluons, the quark-gluon plasma (QGP), has been produced. The quantity most crucial to the probability of QGP formation is the thermalized energy density attained during the heavy-ion reaction. The amount of energy radiated transverse to the beam direction is the experimental quantity which is believed to be a measure of the amount of energy deposition in the reaction, and hence to reflect the energy density attained. In this presentation we consider the systematics of transverse energy production at CERN SPS energies, and we use the results to make estimates, under various assumptions, of attained energy densities. 18 refs., 2 figs.

37598 (JINR-R–1-88-389) **Study on total disintegration of lead nuclei with magnesium-24 nuclei at 4.5 A GeV/c.** Krasnov, S.A.; Tolstov, K.D.; Shabratova, G.S. and others. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1988. 11p. (In Russian). Order Number DE89619102/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Submitted to the journal Acta Phys. Slovaca.

The data on total disintegration of lead with magnetism nuclei at 4.5 A GeV/c momentum are presented. The comparison of these data with those on lead total disintegration by carbon nuclei at the same momentum per nucleon is made. The growth of the number of single charged relativistic particles, strengthening of the collimation of charged secondary emission, increasing of opposite side emission of produced and target destruction particles in the azimuthal plane, strengthening of side splash of these particles with growing mass of a nucleus-projectile are observed. An event with a high density of produced particles per pseudorapidity interval $\sim$ 100 has been registered. The probability of random appearance of this event is equal to 10^{-2}. Comparison with cascade-evaporation model is made. 6 refs.; 9 figs.; 3 tabs.

37599 (LBL–27116) **Excitation and multiple dissociation of projectiles at intermediate energy.** Pouliot, J.; Chan, Y.; Dacal, A.; DiGregorio, D.E.; Harmon, B.A.; Knop, R.; Ortiz, M.E.; Plagnol, E.; Stokstad, R.G.; Moisan, C. Lawrence Berkeley Lab., CA (USA). Apr 1989. 16p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8904153–2: Symposium on nuclear dynamics and nuclear disassembly, Dallas, Texas, USA, 9-14 Apr 1989). Order Number DE89012997/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Cross sections for the multiple breakup of ^{16}O, ^{14}N and ^{12}C projectiles scattered by a Au target were measured with an array of 34 phoswich detectors. The dissociation of the projectiles into as many as five charged particles has been observed. The yields of different exit channels correlate approximately with the threshold energy for separation of the projectile into the observed fragments. The excitation spectrum of the primary projectile-like nucleus was reconstructed from the measured positions and kinetic energies of the individual fragments. The energy sharing between projectile and target is consistent with a fast excitation mechanism in which differential increases in projectile excitation energy appear to be accompanied by comparable increases in target excitation. Calculations of the yields based on a sequence of binary decays are presented. The question of prompt or sequential decay is also considered by examining the directional correlations of the particles. 19 refs., 8 figs.

37600 **Heavy ion reaction studies of $Nb_{A}u$ at E/A = 50, 75 and 100 MeV.** Fields, D.J. (Lawrence Livermore National Lab., CA (USA)); Sangster, T.C.; Webb, M.L.; Remington, B.A.; Britt, H.C.;

Hansen, L.F.; Lanier, R.G.; Massoletti, D.; Namboodiri, M.N.; Struble, G.L. *Nuclear Physics [Section] A (Netherlands),* 495(1/2): 209c-221c (1 May 1989). (CONF-8810261–: International workshop on nuclear dynamics at medium and high energies, Bad Honnef, Germany, F.R., 10-14 Oct 1988).

We report on measurements of the system Nb+Au at incident energies of E/A = 50, 75 and 100 MeV made with a large solid angle, large dynamic range gas-scintillator array. We observe that in these reactions fission is the result of peripheral collisions. Somewhat less peripheral reactions result in heavy residues which do not undergo fission. More central reactions result in high multiplicities of light particles and intermediate mass fragments. Correlations between fragments, energetic light charged particles, and forward moving projectile-like fragments are presented to support these observations.

6520 Nuclear Properties and Reactions, A=220 and Above, Experimental

Refer also to citation(s) 37115, 37607

37601 (GANIL-T–88-02) **Heavy ions reactions below 100 MeV per nucleon: two contributions to the study of subthreshold pion production.** Erazmus, B. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France); Caen Univ., 14 (France). 1988. 152p. (In French). Order Number DE89789261/JAW. Available from NTIS (US Sales Only), PC A08/MF A01.

Angular correlation of fission fragments and branching ratio for fission were measured in the reaction $^{16}O + {}^{232}Th \rightarrow \pi^+ +$ fission. The distributions of impact parameter and linear momentum transfer in pionic collisions have been determined with a Monte-Carlo simulation and compared to the distributions obtained from several theoretical models of subthreshold pion production. A preliminary experiment was performed in order to test directly the model of coherent pion production in the peripheral reaction $^{12}C + {}^{12}C$ at 95 MeV/u. An estimation of the upper limit for the cross section of this mechanism was deduced. An extension of this collective model to all types of nuclear collisions is schematically presented.

37602 (GSI–89-40(prepr.)) **Discovery and confirmation of fission.** Herrmann, G. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Mainz Univ. (Germany, F.R.). Inst. fuer Kernchemie. Apr 1989. 20p. (CONF-890491–: International conference on fifty years of research in nuclear fission, Berlin, Germany, F.R., 3-7 Apr 1989). Available from Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

An outline of the history of fission is presented beginning 1934, when fission products were first produced by neutron-irradiation of uranium but were attributed to transuranium elements, till December 1938, when fission was discovered with radiochemical techniques and confirmed in the following weeks with physical methods.

37603 (HMI-B–463) **Multiplicity of neutrons from violent heavy-ion collisions: $^{40}Ar + Th$ and U from 10 to 77 MeV/u.** Jahnke, U.; Cramer, B.; Ingold, G.; Schwinn, E.; Charvet, J.L.; Frehaut, J.; Lott, B.; Morjean, M.; Patin, Y.; Pranal, Y. Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.); Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France); Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Dec 1988. 22p. (CONF-8809118–: 20. summer school on nuclear structure studies by means of nuclear reactions: heavy ions in nuclear and atomic physics, Mikolajki, Poland, 2-11 Sep 1988). Order Number DE89783054/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

With large 4π scintillator tanks the multiplicity of neutrons released from the most dissipative reactions in 10 to 77 MeV/u ^{40}Ar induced collisions with Th and U nuclei has been investigated. The central issue is the relation between the fission-fragment folding angle or linear momentum transfer and the multiplicity of evaporated neutrons and charged particles or dissipated energy. Their multiplicity points to a 'soft saturation' of the maximum energy deposit with increasing bombarding energy near 700 MeV of excitation. Unlike the folding-angle distributions, the inclusive neutron multiplicity spectra, which are unbiased by specific decay properties of the intermediate nuclear system, do not show a decline of the most dissipative processes within this range of incident energy.

37604 (JINR-R–15-88-385) **Study on fragment charge and mass fragmentation in ^{235}U fission with resonance neutrons.** Bogdzel', A.A.; Gundorin, N.A.; Duka-Zolyomy, A.; Kliman, J.; Kristiak, J. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics. 1988. 12p. (In Russian). Order Number DE89619108/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The results of the study of charge and mass fragmentation during ^{235}U fission with resonance neutrons are presented. The techique was used based on measuring the instant gamma-radiation from fission fragments. Parameters of isobaric yield distribution and the values of even-odd effect for a light and heavy fragment groups are presented. 15 refs.; 4 figs.; 3 tabs.

37605 (UCRL–101086) **Technique for fission measurements of highly active and weak cross-section actinides.** Block, R.C.; Slovacek, R.E.; Hoff, R.W.; Nakagome, Yoshihiro. Lawrence Livermore National Lab., CA (USA). 1989. 14p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890406–24: Fifty years with nuclear fission conference, Gaithersburg, MD, USA, 25-28 Apr 1989). Order Number DE89014102/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Rensselaer Intense Neutron Spectrometer (RINS) system provides an intense neutron source that is well suited for measuring the fission cross sections of microgram quantities of highly-active actinides and gram quantities of nuclei with very weak cross sections. The system consists of a 75-ton lead assembly driven by the RPI electron linac, and the neutron fluxes are three-to-four orders of magnitude more intense than those available in conventional time-of-flight measurements. Examples of measured cross sections of curium isotopes ^{238}U and ^{232}Th are presented. 17 refs., 10 figs., 1 tab.

6530 Nuclear Theory

Refer also to citation(s) 37560, 37589, 37605

37606 (ANU-P–986) **Measurement and statistical model analysis of pre-fission neutron multiplicities.** Newton, J.O.; Hinde, D.J.; Charity, R.J.; Leight, J.R.; Bokhorst, J.J.M.; Chatterjee, A.; Foote, G.S.; Ogaza, S. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Jan 1988. 48p. Order Number DE89619039/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The average number of neutrons preceding fission was measured for the compound systems ^{168}Yb, ^{178}W, ^{188}Pt, ^{192}Pb, ^{198}Pb, ^{200}Pb, ^{210}Po, ^{213}At and ^{251}Es formed by reactions induced by ^{16}O, ^{18}O, ^{19}F, ^{28}Si or ^{30}Si projectiles with energies (E) between 4.9 and 7.2 MeV/A. In some cases ν is seen to increase with increasing E above a threshold energy (E_{th}) whereas the statistical model indicates that it should decrease. Below E_{th}, the variation of ν with E is consistent with statistical model predictions. The deviations above E_{th} have been attributed to dissipative effects not included in the model. Extensive statistical model and chi-squared analyses of the pre-fission data below E_{th} and of fission and fusion excitation function data, previously measured, were made. The diffuseness parameters of the fusion spin-distributions agreed reasonably well with those suggested by the zero-point motion model. The ratios of level densities at saddle and equilibrium deformations were found to be consistent with a value of unity, and the fission barriers consistent with the predictions of the finite-range rotating liquid-drop model.

37607 (ANU-P–988) **Mass-split dependence of the pre- and post-scission neutron multiplicities for fission of ^{251}Es.** Hinde, D.J.; Leigh, J.R.; Bokhorst, J.J.M.; Newton, J.O.; Walsh, R.L.; Boldeman, J.W. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Jul 1987. 37p. Order Number DE89619040/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Pre- and post-scission neutron multiplicities have been measured as a function of fission mass-split for the reactions of 105 and 120 MeV ^{19}F with ^{232}Th. The post-scission multiplicities show no

evidence for persistence of the sawtooth yield observed for spontaneous fission of ^{252}Cf; the dependence on mass-split is not consistent with the random neck rupture model. The pre-scission multiplicities show no evidence of quasi-fission for asymmetric mass-splits. It is proposed that pre-scission neutron multiplicity measurements should be a useful tool in studying quasi-fission produced by reactions with heavier projectiles.

37608 (GANIL-P–88-04) **Compressional effects in heavy ion collisions: spinodal decomposition and thermal energy saturation.** Suraud, E.; Pi, M.; Schuck, P.; Remaud, B.; Sebille, F.; Gregoire, C.; Saint-Laurent, F. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1988. 15p. Order Number DE89789231/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Using a kinetic equation (the Landau-Vlasov equation) an analysis of the balance between thermal and collective energies is performed for the heavy-ion collisions in the 30-100 MeV/u bombarding energy range. It is shown that a substantial amount of energy is stored in the compression modes, which limits strongly the excitation energy available for particle evaporation, in strong correlation with the experimentally-observed trend. Secondly the related phenomenon of spinodal decomposition is studied in detail within the present theory. The sensitivity of the amplitude and frequency of the monopole oscillation to the nuclear incompressibility modulus is discussed.

37609 (IC–89/19) **Enlarged superfluid model of atomic nucleus.** Dumitrescu, O.; Horoi, M. International Centre for Theoretical Physics, Trieste (Italy). Jan 1989. 27p. Order Number DE89618976/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The well known superfluid model (or quasiparticle phonon nuclear model (QPNM)) of atomic nucleus is enlarged by including an adequate four-nucleon effective interaction in addition to the pairing and long-range effective residual interactions. New experimental data can be explained without affecting those observables already described by the QPNM and in addition new features can be enumerated: (1) superfluidities of the neutron and proton systems may be generated by one another; (2) the phase structure is enriched by a new superfluid phase dominated by alpha-type correlations (ATC) and (3) superfluid isomers and their bands of elementary excitations are predicted. Unusual large two-nucleon and alpha transfer reactions cross sections as well as some unusual large alpha decay widths can be explained. (author). 46 refs, 3 figs, 2 tabs.

37610 (INDC(CCP)–293/L, pp. 49-57) **Evaluation of total interaction cross-sections for nuclei with mass number 3.** Zvenigorodskij, A.G.; Guzhovskij, B.Ya.; Abramovich, S.N.; Zherebtsov, V.A.; Pelipenko, O.A. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. In *Translation of selected papers published in Nuclear Constants 3, 1985.* Order Number DE89613037/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Original report in Russian was distributed as INDC(CCP)-252/G.

The paper presents some aspects of evaluating the cross-sections for the reactions $^3H(t,2n)^4He$, $^3He(^3He,2p)^4He$, $^3He(t,x)n$ and $^3He(t,d)^4He$ which are important in the field of thermonuclear fusion and astrophysics. 4 figs, 6 tabs.

37611 (INDC(NDS)–214/LJ, pp. 91-98) **On the two gas approach for exciton model master equation.** Reffo, G. (ENEA, CRE Clementel, Bologna (Italy)); Herman, M.; Costa, C. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. (CONF-880239–: 2. research co-ordination meeting on methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors, Vienna, Austria, 14-20 Feb 1988). In *Status review of methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors. Texts of invited papers presented during the second research co-ordination meeting, Vienna, 15-17 February 1988.* Order Number DE89008469/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

A new version of the two component exciton model with introduction of shell model quasi-particle state densities is presented. A transformation of the master equation is proposed to facilitate the calculations. On this basis, flux flow between different substages of the composite nucleus is analysed and large discrepancies are found in the strength of various transitions. (author). 8 refs, 5 figs.

37612 (INDC(NDS)–214/LJ, pp. 69-74) **Consistent systematics of nuclear level densities for mean and heavy nuclei.** Grudzevich, O.T. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Ignatyuk, A.V.; Plyaskin, V.I. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. (CONF-880239–: 2. research co-ordination meeting on methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors, Vienna, Austria, 14-20 Feb 1988). In *Status review of methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors. Texts of invited papers presented during the second research co-ordination meeting, Vienna, 15-17 February 1988.* Order Number DE89008469/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The systematics of the experimental data on the density of neutron resonances and low-lying levels is considered taking into account the vibrational increase of the level density together with the shell and superconductive effects. (author). 12 refs, 2 figs.

37613 (INDC(NDS)–214/LJ, pp. 7-24) **Some fundamental aspects of the optical potential for the interaction of fast neutrons with cobalt.** Smith, A.B. (Argonne National Lab., IL (USA)); Lawson, R.D. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. (CONF-880239–: 2. research co-ordination meeting on methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors, Vienna, Austria, 14-20 Feb 1988). In *Status review of methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors. Texts of invited papers presented during the second research co-ordination meeting, Vienna, 15-17 February 1988.* Order Number DE89008469/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

Differential elastic- and inelastic-scattering cross sections, measured from approx. 1.5 to 10.0 MeV, are interpreted in terms of spherical-optical-statistical (OM) and coupled-channels models. A successful description of the differential elastic scattering below 10 MeV and the total cross section to 20.0 MeV is achieved using the spherical OM with energy-dependent strengths and geometries. These energy dependencies are large below approx. 7.0 MeV, but become smaller and similar to those reported for "global" potentials at higher energies. This change in the energy dependence of the parameters probably marks the onset of the Fermi surface anomaly approx. 19 MeV above the Fermi energy. Inelastic scattering to the levels below 1.8 MeV displays a forward peaked behavior. This non-statistical component is interpreted using the weak coupling model in which the f_72/proton hole is coupled to the 2^+ state in ^{60}Ni. This model provides an explanation of the unusual energy dependence and relatively small radius found for the imaginary OM potential. The coupling also contributes to the large value of this potential. The real spherical OM potential derived from the neutron-scattering results is extrapolated to bound energies using the dispersion relationship and the method of moments. The resulting real-potential strength and radius peak at approx. -10.0 MeV, whereas the real diffuseness is at a minimum at this energy. The extrapolated potential is approx. 8% larger than that implied by reported particle-state energies, and approx. 13% smaller than indicated by hole-state energies. (author). 42 refs, 8 figs.

37614 (INDC(NDS)–214/LJ, pp. 25-47) **Optical-model calculations for experimental interpretation and evaluation: Practical considerations and fundamental implications.** Smith, A.B. (Argonne National Lab., IL (USA)); Guenther, P.T.; Lawson, R.D. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. (CONF-880239–: 2. research co-ordination meeting on methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors, Vienna, Austria, 14-20 Feb 1988). In *Status review of methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors. Texts of invited papers presented during the second research co-ordination meeting, Vienna, 15-17 February 1988.* Order Number DE89008469/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The report presents the status of the project concerning the measurement, calculation and evaluation of neutron data for structural materials in the mass regions A approx.= 50-60, 90-100 and 204-209. Figs.

37615 (INDC(NDS)–214/LJ, pp. 49-68) **Neutron optical model potential.** Hodgson, P.E. (Oxford Univ. (UK). Nuclear Physics Lab.). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. (CONF-880239–: 2. research co-ordination meeting on methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors, Vienna, Austria, 14-20 Feb 1988). In *Status review of methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors. Texts of invited papers presented during the second research co-ordination meeting, Vienna, 15-17 February 1988.* Order Number DE89008469/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The present status of optical model calculations of neutron scattering and interactions is reviewed, with special emphasis on more recent developments and the more promising lines of research. The use of dispersion relations to provide an extra constraint on the potential is discussed, together with their application to studies of the Fermi surface anomaly. The application of potential inversion techniques to determine the form of the potential is also considered. (author). 39 refs, figs.

37616 (INDC(NDS)–214/LJ, pp. 75-78) **Effects of realistic partial state densities on preequilibrium decay.** Blann, M. (Lawrence Livermore National Lab., CA (USA)); Reffo, G. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. (CONF-880239–: 2. research co-ordination meeting on methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors, Vienna, Austria, 14-20 Feb 1988). In *Status review of methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors. Texts of invited papers presented during the second research co-ordination meeting, Vienna, 15-17 February 1988.* Order Number DE89008469/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The results of neutron spectra calculations for proton induced reactions in Zirconium isotopes using realistic partial state densities for preequilibrium decay are presented. 5 refs, 1 fig.

37617 (INDC(NDS)–214/LJ, pp. 79-89) **MSC calculations with use of EMPIRE.** Marcinkowski, A. (Institute for Nuclear Studies, Warsaw (Poland)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. (CONF-880239–: 2. research co-ordination meeting on methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors, Vienna, Austria, 14-20 Feb 1988). In *Status review of methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors. Texts of invited papers presented during the second research co-ordination meeting, Vienna, 15-17 February 1988.* Order Number DE89008469/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The multi-step compound emission (MSC) theory has been used through the EMPIRE code to evaluate the preequilibrium cross sections in the excitation curves and neutron-emission spectra of neutron reactions for ^{92}Mo and ^{100}Mo. 14 refs, 4 figs.

37618 (INDC(NDS)–214/LJ, pp. 99-110) **Analysis of threshold reaction cross-sections and spectra of particles emitted in them on iron-group nuclei.** Bychkov, V.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Grudzevich, O.T.; Zelenetsky, A.V.; Pashchenko, A.B.; Plyaskin, V.I. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. (CONF-880239–: 2. research co-ordination meeting on methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors, Vienna, Austria, 14-20 Feb 1988). In *Status review of methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors. Texts of invited papers presented during the second research co-ordination meeting, Vienna, 15-17 February 1988.* Order Number DE89008469/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

An analysis of excitation functions and particle emission spectra in neutron reactions with nuclei in the mass range 50-70 has been performed within the framework of theoretical models of nuclear reactions. 19 refs, 7 figs.

37619 (INDC(NDS)–214/LJ, pp. 111-125) **Investigation of the angular distribution of secondary energy dependent inelastic neutron cross sections in structural materials using Blann's geometry dependent hybrid model.** Bahm, E. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik); Jahn, H. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. (CONF-880239–: 2. research co-ordination meeting on methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors, Vienna, Austria, 14-20 Feb 1988). In *Status review of methods for the calculation of fast neutron nuclear data for structural materials of fast and fusion reactors. Texts of invited papers presented during the second research co-ordination meeting, Vienna, 15-17 February 1988.* Order Number DE89008469/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The measured results for the 14.6 MeV inelastic neutron cross-sections show considerable experimental errors in particular in forward direction. Also remarkable discrepancies between these measured results of the different experimental groups are to be observed. Consequently it is not possible to draw definitive conclusions concerning the validity of the various concepts of nuclear reaction mechanisms from these inaccurate measured results. In this paper we show that the situation is considerably improved if we add information from the results of measurements of the inelastic proton scattering cross-sections. With this additional information we obtain a sufficient starting point to calculate rather accurate and unique results for the double differential cross-sections of inelastic neutron scattering at the high energy tail of the secondary energy. This is demonstrated by a few examples of ^{56}Fe. Moreover by applying certain averages to the angle integrated inelastic cross-sections the results of the geometry dependent hybrid model are obtained. Consequently this might be a hint to a more rigorous derivation of this model. (author). 21 refs, 5 figs, 1 tab.

37620 (INFN/BE–89/3) **Generalised exciton model theories for the description of pre-equilibrium angular distributions.** Gadioli, E. Istituto Nazionale di Fisica Nucleare, Milan (Italy). 22 Feb 1989. 21p. (CONF-890198–2: International conference on nuclear reaction mechanism, Calcutta, India, 3-9 Jan 1989). Order Number DE89013025/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI.

The theories proposed to reproduce, in the framework of the exciton model, the angular distributions of pre-equilibrium particles are reviewed. It is shown that, contrary to a widespread opinion, the most refined calculations based on these theories allow a satisfactory reproduction of the experimental data, that is comparable to that obtainable with quantum-mechanical multistep theories. 28 refs., 8 figs.

37621 (INIS-mf–11396, pp. 80) **Nucleon as a color magnetic soliton.** Greben, J.M. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Research Inst. for Mathematical Sciences). South African Inst. of Physics, Faure (South Africa). 1987. (CONF-8707216–: 32. Annual conference of the South African Institute of Physics, Durban, South Africa, 13-17 Jul 1987). In *32nd Annual conference and the 22nd annual theoretical seminar of the South African Institute of Physics.* Order Number DE89615754/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

This publication contains only the abstracts of seminars.

NUCLEONS/quantum chromodynamics; NUCLEONS/solitons; COLOR MODEL; EQUATIONS OF MOTION; NUCLEONS; SOLITONS; QUARK-GLUON INTERACTIONS

37622 (INIS-mf–11396, pp. 81) **Observation of a deviation from Bhabha scattering in the electron-positron system.** Von Wimmersperg, U. (Wits-CSIR Schonland Research Centre for Nuclear Sciences, University of the Witwatersrand, Johannesburg (South Africa)); Connell, S.H.; Hoernle, R.F.A.; Sideras-Haddad, E.

South African Inst. of Physics, Faure (South Africa). 1987. (CONF-8707216–: 32. Annual conference of the South African Institute of Physics, Durban, South Africa, 13-17 Jul 1987). In *32nd Annual conference and the 22nd annual theoretical seminar of the South African Institute of Physics.* Order Number DE89615754/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

This publication contains only the abstracts of seminars.

BHABHA SCATTERING/electron-positron interactions; ELECTRONS; POSITRONS; SILICON 27

37623 (INIS-mf–11438) **Investigation of relativistic heavy ion interactions with the atomic nuclei.** Rosu, C.H. Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering. 1987. 22p. (In Romanian). Order Number DE89615781/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Published in summary form only.

The relativistic heavy ion reactions are investigated.

37624 (INIS-mf–11440, pp. 28-29) **Investigation of the excited O^+ states in Cd-110 and Ce-1138.** Bucurescu, D. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering); Cata, G.; Cutoiu, D.; Ivascu, M.; Zamfir, N.V.; Julin, R.; Kantele, J.; Kumpulainen, J.; Verho, E. Central Inst. of Physics, Bucharest (Romania). 1988. (In Romanian). (CONF-8810372–: Advances in physics, Constanta, Romania, 6-8 Oct 1988). In *Advances in Physics.* Order Number DE89012158/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The X-ratio was determined for the O^+_2 state in Ce-138 and O^+_4 in Cd-110. (authors).

37625 (INIS-SU–77/A, pp. 438) **Estimations and theoretical forecasting of ^{236}U neutron data in the energy range of neutrons up to 20 MeV.** Klepatskij, A.B. (AN Belorusskoj SSR, Minsk (Byelorussian SSR). Inst. Yadernoj Ehnergetiki); Maslov, V.M.; Porodzinskij, Yu.V.; Sukhovitskij, E.Sh. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 14-18 Sep 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01; INIS.

URANIUM 236 TARGET/neutron reactions; MEV RANGE 01-10; MEV RANGE 10-100

37626 (INIS-SU–77/A, pp. 439) **GRVKON-6 applied program package for calculation of neutron group constants.** Sinitsa, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Rinejskij, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 14-18 Sep 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01; INIS.

NUCLEAR DATA COLLECTIONS/group constants; G CODES; NEUTRON REACTIONS

37627 (IPNO-DRE–87-38) **Spin value of ^{184}Ir ground state.** Bourgeois, C.; Kilcher, P.; Roussiere, B.; Sauvage, J.; Porquet, M.G.; Dautet, H.; Lee, J.K.P.; Isocelle Collaboration. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1987. 26p. Order Number DE89789229/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

In order to determine the spin value of the ^{184}Ir ground state its β^+/EC decay has been investigated using the ISOCELE facility. A detailed ^{184}Os level scheme has been obtained. Spin and parity assignments have been deduced from transition multipolarities. The $Q_{\beta+}$ value has been measured to be 3260 $\pm$ 70 keV by means of a solid state ΔE-E telescope and log ft values have been calculated for the levels which are the most clearly fed. Contrary to results previously reported, the ground-state band of ^{184}Os is not directly populated. It is concluded that the ^{184}Ir ground-state has spin and parity value I^π : 4^- or 5^- with projection value K which may be 4 and/or 5. The ^{184}Os levels are compared to those of the other osmium isotopes and their structure discussed.

37628 (IPNO-DRE–87-40) **Excitation of the Δ resonance in heavy ion charge exchange reactions.** Roy-Stephan, M. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Jun 1987. 10p. (CONF-8709200–: 1. topical meeting on giant resonance excitation in heavy-ion collisions, Legnaro, Italy, 21-25 Sep 1987). Order Number DE89781508/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

Results on the Δ excitation by heavy ion charge exchange are presented. 900 MeV per nucleon ^{12}C, ^{16}O, ^{20}Ne and 1100 MeV per nucleon ^{12}C have been used. The Δ excitation strength depends on the projectile - ejectile nature and on the incident energy. The role of the target mass is also discussed. The peak for the Δ in nuclei is energy shifted from the free Δ peak.

37629 (IPNO-DRE–87-42) **High lying and high spin states in heavy nuclei via transfer reactions.** Langevin-Joliot, H. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Oct 1987. 53p. (CONF-8710231–: 8. international school on nuclear physics, neutron physics and nuclear energy, Varna, Bulgaria, 19-28 Oct 1987). Order Number DE89781507/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

Our knowledge of the nucleus response to single particle and two particle modes of excitation has made significant progresses for the recent years. The general properties of transfer reactions, the independent particle model approach, the spreading process of the bare hole or particle states are briefly recalled in the introduction. High lying single particle modes have been identified in many heavy nuclei as 'giant structures'. Selected examples are presented to illustrate the experimental methods and the recent trends with emphasis on the study of proton hole states up to very high excitation energy. Giant structures have also been observed via two neutron pick-up reactions. These valence deep hole states are briefly surveyed with emphasis on the localization of their higher spin components. The recent observation of high spin and high lying neutron-proton particle levels and structures is then presented and discussed.

37630 (IPNO-DRE–88-21) **Isovector and isoscalar spin-flip excitations in even-even s-d shell nuclei excited by inelastic proton scattering.** Marty, N.; Morlet, M.; Willis, A.; Djalali, C.; Crawley, G.M.; Anantaraman, N.; Brown, B.A.; Galonsky, A. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1988. 30p. Order Number DE89789224/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Forward-angle cross sections for 1^+ states have been measured in ^{24M}g ^{26}Mg, ^{28}Si and ^{32}S by 201 MeV proton inelastic scattering. Comparisons are made with (γ, γ'), (e,e') and (p,n) results. The measured strength is compared with microscopic distorted-wave Born approximation calculations using large scale shell model wave functions. Ratios of experimental to theoretical 1^+ strengths are given. Almost no quenching is observed.

37631 (JINR-E–4-88-543) **Dipole octupole correlations in a boson model and evidence for their existence in nuclei.** Mikhajlov, I.N.; Nadzhakov, E.G.; Aiche, M.; Schulz, N.; Vanin, V.; Briancon, Ch. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Paris-11 Univ., 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse. 1988. 10p. Order Number DE89618987/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Submitted to the journal J. Phys., G.

The interacting multi boson model (IMBM) introduced earlier, in its spdf boson case, is applied to a new experiment on the vibrational nucleus $^{218}_{88}Ra_{130}$. It is shown to describe in a ntural way, with the essential participation of pf bosons, both the ground yrast bands with positive and negative parity, and the peculiar side yrare bands with the same space π and opposite spin (-(1)) parity. So this experiment together with its boson interpretation can be viewed as evidence for the existence of combined dipole octupole correlations in nuclei. 9 refs.; 2 figs.; 1 tab.

37632 (JINR-R–1-88-331) **Automodel properties of baryon clusters in interactions of p-, d-, He-, C- and π^--particles with**

carbon nuclei within 4-40 GeV/c per nucleon momentum interval. Baldin, A.M.; Grishin, V.G.; Didenko, L.A.; Kuznetsov, A.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1988. 18p. (In Russian). Order Number DE89619019/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Submitted to the journal Yad. Fiz.

The properties of baryon clusters produced in interactions of p-, d-, He-, C- and π^--particles with carbon nuclei are studied for the experimental verification of principle of the correlation depletion and those of the second ranke automodelity formulated in the relativistic invariant approach. It is shown that baryon clusters produced in the intermediate region of relativistic nuclear interactions are characterized by universal properties over two similar parameters: scale noninvariant b_k and scale invariant x_k, i.e. proton distributions in clusters for the same nuclear target on these variables depend neither on the type of the projectile not on its energy within the 4-40 GeV interval. 12 refs.; 12 figs.; 4 tabs.

37633 (JINR-R–3-88-371) **Intensive two-quantum cascades and fragmentation of quasiparticle states in some deformed nuclei.** Boneva, S.T.; Vasil'eva, Eh.V.; Malov, L.A.; Popov, Yu.P.; Sukhovoj, A.M.; Khitrov, V.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics. 1988. 12p. (In Russian). Order Number DE89618988/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Submitted to the journal Yad. Fiz.

Distributions of sums of intensities of primary γ-transitions following neutron capture (their low limit) are compared with strength distributions of fragmented single-quasiparticle states of the deformed Saxon-Woods potential in dependence on excitation energy of ^{165}Dy, ^{175}Yb and ^{179}Hf compound nuclei. The calculated interval of maximum strength of fragmented states 510arrow up, 521arrow down, 501arrow down and 501arrow up coincides within a few hundreds keV with the excitation energy range of the observed enhancement of primary transitions. This enhancement is assumed to be due to the presence of appreciable single-quasiparticle wave function components of two excited states connected by a primary transition. 15 refs.; 4 figs.

37634 (JINR-R–15-88-386) **Analysis of dynamic characteristics of ^{235}U fission with resonance neutrons on the basis of data on fission fragment charge and mass fragmentation.** Gundorin, N.A.; Duka-Zolyomy, A.; Kliman, J.; Kristiak, J. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics. 1988. 13p. (In Russian). Order Number DE89619046/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

On the basis of analysis of isobaric disribution dispersion of fission fragments and even-odd proton and neutron effect values appearing at the ^{236}U fission with resonance neutrons the value of internal excitation energy is estimated ed as 5,9 MeV and dissipation energy as 5 MeV. Deformation energy at the rupture point is estimated to be equal to 13,6-16,6 MeV. These values are in agreement with the calculations for two-body dissipation on condition that the coefficient of dynamic viscosity of nuclear matter is $1{,}10^7$. 33 refs.; 1 tab.

37635 (Lund-MPh–87/06) **On the feeding and spectroscopy of superdeformed states.** Aberg, S. Lund Inst. of Tech. (Sweden). Dept. of Mathematical Physics. Mar 1987. 33p. (CONF-870153–: 25. international winter meeting on nuclear physics, Bormio, Italy, 19-24 Jan 1987). Order Number DE89783600/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Based on a cranked Nilsson calculation we discuss some spectroscopic properties of superdeformed nuclei, like quadrupole moments, g-factors, energies and moments of inertia. In light of recent experimental information about superdeformations in ^{152}Dy, possible feeding mechanisms of these states are discussed. The high-spin level density is calculated in a microscopic model, and the number of superdeformed states, compared to normal-deformed states, is found to be high for high spins and for low excitation energies. This suggests favoured regions in the (E_{exc},I)-plane for the feeding of superdeformed states. A microscopic model for rotational damping is presented, and the E2-strength function up to about 4 MeV excitation energy is studied. The rotatinal cooling at $1 \simeq 50$ in the superdeformed HD Dy is found to be much smaller than in the normal-deformed ^{168}Yb.

37636 (UCRL–99847) **Fission barriers for r-process nuclei and implications for astrophysics.** Meyer, B.S.; Mumlt oller, P.; Howard, W.M.; Mathews, G.J. Lawrence Livermore National Lab., CA (USA). 15 May 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890406–23: Fifty years with nuclear fission conference, Gaithersburg, MD, USA, 25-28 Apr 1989). Order Number DE89014265/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We present calculations of fission-barrier heights, beta decay energies, and neutron separation energies for nuclei with $76 \leq Z \leq 100$ and $140 \leq N \leq 184$. For these nuclear-structure calculations we use the macroscopic-microscopic method with a Yukawa-plus-exponential macroscopic model and a folded-Yukawa microscopic model. The barrier-heights we find are higher than those calculated in previous studies using the droplet macroscopic model. We discuss the implications of the new results on fission-barrier heights for astrophysics. 15 refs., 6 figs.

37637 Approximation of precompound effects in Hauser-Feshbach codes for calculating double differential (n, xn) cross sections. Fu, C.Y. (Oak Ridge National Lab., Oak Ridge, TN (US)). *Nuclear Science and Engineering (USA)*, 100(1): 61-76 (Sep 1988).

A simplified method for approximating precompound nuclear reaction effects in Hauser-Feshbach codes for the calculation of double differential (n,xn) cross sections is presented. The method is developed from an existing quantum mechanical formula of unified compound and precompound reaction theories. The compound part of the unified formula is made identical to that of Hauser and Feshbach by applying the unified level-density formulas derived previously for the two theories. The precompound part, much more complicated than the compound part, is simplified and globally parameterized for practical purposes. Calculated double differential (n,xn) cross sections at 14 and 26 MeV for iron, niobium, and bismuth are shown to be in good agreement with the available experimental data.

37638 $K^{\pm}$, p^-, and Ω^- production in relativistic heavy ion collisions. Koch, P. (State University of New York at Stony Brook, Stony Brook, New York 11794(US)); Dover, C. B. *Physical Review [Section] C: Nuclear Physics (USA)*, 40(1): 145-155 (Jul 1989). DOE Contract AC02-76ER13001.

We discuss the production of antiprotons, kaons, and the Ω^- in nuclear collisions at relativistic energies in the framework of a simplifiedhadrochemical model. We point out the importance of Δ resonances forp^- as well as K^- production at 1–2 GeV/nucleon,particularly in the region below the threshold for their production inindividual *NN* collisions. Quark matter formation may enhanceΩ^- production to a measurable level at 15 GeV/nucleon.

6540 Radiation and Shielding Physics

Refer also to citation(s) 36196, 37156

37639 (CONF-8810118–10) **Density dependence of the momentum distribution in normal liquid ^{4}He.** Herwig, K.W.; Sokol, P.E.; Sosnick, T.R.; Snow, W.M.; Blasdell, R.C. Argonne National Lab., IL (USA). 1988. 25p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Workshop on momentum distributions; Argonne, Illinois, USA; 24-26 Oct 1988. Order Number DE89014678/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Deep inelastic neutron scattering measurements on normal liquid ^{4}He at 4.25 K have been carried out at eleven densities between 0.125 (saturated vapor pressure) and 0.200 gm/cm^3, at a momentum transfer of 23 Å^{-1}. A sum of two Gaussians is required to characterize the scattering at all densities, even when the broadening due to instrumental resolution and corrections to the impulse approximation are included. The kinetic energy varies from 15.5 K at 0.125 gm/cm^3 to 3.27 K at 0.200 gm/cm^3. 24 refs., 9 figs., 2 tabs.

6550 Medical Physics

Refer also to citation(s) 36155

37640 (CNEA-N–2/87) **Safety guide of the Tandar accelerator.** Comision Nacional de Energia Atomica, Buenos Aires

(Argentina). Dept. de Fisica. 1987. 16p. (In Spanish). Order Number DE89619917/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The safety standards that the installations of the Tandar accelerator have to comply with are presented here. In order to maintain the safety, the knowledge and the accomplishment of these standards are mandatory for all persons. The risks of external irradiation and of contamination are pointed out. The risks at the Tandar are: the calibration standards used at the premises and the irradiation produced by the activity of the accelerator, which can be primary, secondary, induced or X rays. The identification of the different areas of installation are given with their corresponding classification; the rules concerning the manipulation of radioactive materials and the movement of persons in areas of reglamentary access are established. Finally conventional safety and rules for evacuation and fires are presented. (M.E.L.).

37641 (INFO–0257) **Comparing personal alpha dosimetry with the conventional area monitoring-time weighting methods of exposure estimation: a Canadian assessment.** Balint, A.B.; Viljoen, J. Atomic Energy Control Board, Ottawa, ON (Canada). Jan 1988. 24p. Order Number DE89619936/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

An experimental personal alpha dosimetry program for monitoring exposures of uranium mining facility workers in Canada has been completed. All licenced operating mining facilities were participating. Dosimetry techniques, description of dosimeters used by licences, performance and problems associated with the implementation of the programme as well as technical and administrative advantages and difficulties experienced are discussed. Area monitoring-time weighting methods used and results obtained to determine individual radon and thoron daughter exposure and exposure results generated by using dosimeters are assessed and compared.

37642 (INIS-mf–11448, pp. 17) **Review of radiation safety at a gamma sterilization plant.** Robotham, F.P.J. Australian Inst. of Nuclear Science and Engineering, Lucas Heights (Australia). 1987. (CONF-8708339–: 11. AINSE radiation biology conference, Lucas Heights, Australia, 24-25 Aug 1987). In *Conference handbook.* Order Number DE89616297/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

RADIATION DOSES/irradiation plants; FOOD; GAMMA RADIATION; IRRADIATION; RADIATION PROTECTION; RISK ASSESSMENT; SAFETY STANDARDS

37643 (INIS-mf–11448, pp. 39) **Outline of the proposed radioecology study at the Maralinga Weapons Test site.** Giles, M.S. (Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia)). Australian Inst. of Nuclear Science and Engineering, Lucas Heights (Australia). 1987. (CONF-8708339–: 11. AINSE radiation biology conference, Lucas Heights, Australia, 24-25 Aug 1987). In *Conference handbook.* Order Number DE89616297/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

SURFACE CONTAMINATION/radioecological concentration; ENVIRONMENTAL EXPOSURE PATHWAY; FOOD CHAINS; INGESTION; NUCLEAR EXPLOSIONS; NUCLEAR WEAPONS; RADIATION DOSES; RADIONUCLIDE MIGRATION; SOUTH AUSTRALIA; TESTING

37644 (INIS-mf–11461) **Guidelines for approved medical officers on health surveillance of radiation workers.** O'Donovan, N.; Hone, C. Nuclear Energy Board, Dublin (Ireland). Nov 1988. 14p. Order Number DE89619925/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

As a result of the adoption of the Council of the European Communities Directive No. 80/836 Euratom which lays down the basic safety standards for the health protection of the general public and workers against the dangers of ionizing radiation, there is a need for nominating Approved Medical Officers whose functions in respect of hospital workers are outlined in the Department of Health Circular, Oct. 1983 (Appendix 1), and which are considered applicable to all other workers. This document outlines the role of the Approved Medical Officer and proides information to aid him/her in this work

37645 (INIS-SU–82) **Radiation hygiene. Collection of scientific papers.** Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. 189p. (In Russian). Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01.

Individual papers in this collection are separately indexed.

37646 (INIS-SU–82, pp. 5-8) **Main trends of radiation hygiene development in 9 Five-Jear Plan.** Ramzaev, P.V.; Arkhangel'skaya, G.V.; Tikhonova, A.I. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Native and foreign literature on substantiation of prospects of radiation hygiene development and optimum solution of the most vital problems are analysed. The following trends are called the main ones: dosimetric, estimation of low dose irradiation negative effect and the effect degree depending on prenatal irradiation, estimation of genetic effects of irradiation. Much attention is paid to analysis of acutetotal and local-radiation effects and to development of radiation protection means and ways. 7 refs.

37647 (INIS-SU–82, pp. 22-26) **Formation of gamma background of building materials with additives of slags and ashes from coal thermal power plants.** Obukhova, O.L. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Radiation background of building materials with coal additives is established. The obtained dose rate values for cinder block buildings were not so high as those of usual building materials (the difference didn't exceed 70%). But when measuring natural radionuclide content in native coils of different deposits coal with specific activity greatly exceeding the data obtained from measuring the building material samples occurred. Use of such coal wastes will result in abrupt increase of people irradiation in buildings, but even that incresae, as a rule, does not fall outside the limits of usual fluctuations of natural radiation background. 7 refs.; 2 tabs.

37648 (INIS-SU–82, pp. 26-29) **Experimental data on weakening gamma-radiation by boring well.** Prokof'ev, O.N.; Minina, O.B. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Coefficient of boring well weakening gamma-radiation from fall-out is experimentally determined. A plane gamma source is imitated using 2390 MBq ^{137}Cs point source. Five wells 2 cm in diameter and 10 cm in depth were sited on experimental ground. The radiation source was placed 5, 10 and 20 cm above the earth, above the central well and displaced. Thermoluminescent dosimeters were disposed on the ground near the mouth and on each well floor. The experimental data confirm boring well weakening of gamma-radiation from fall-out on the ground surface. 1 ref.; 1 tab.

37649 (INIS-SU–82, pp. 33-38) **Review of investigations concerning radioactive aerosol deposition in lungs of man.** Korelina, N.F. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

On the basis of reviewed data on coefficients of radioactive aerosol deposit in respiratory tract of man a conclusion is made that MKRZ model suggested in 1966 satisfactorily (not accounting biological variability) describes coefficients of radioactive particle deposition in different parts of human respiratory tract during inhalation of 0.2-200 μm aerozols. It is marked that human respiratory system is subdivided into 3 main parts: rhinopharyngeal, tracheobronchial and alveolar. Deposition coefficients in tracheobronchial part over the past few years of experiments are approximately 10-15% higher than in MKRZ model. It is stated that when calculating the lung doses different sources of depositon factor variability, relating to dispersion of radioactive particles, standard biological variability and lung pathology must be taken account of. 22 refs.

37650 (INIS-SU–82, pp. 9-14) **Theory and practice of sanitary inspection of radiological units.** Poplavskij, K.K.; Karlin, N.E.; Katsnel'son, G.M.; Koroleva, T.M.; Lisenkova, L.N.; Smorodintseva, G.I.; Travnikova, I.G. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

A report based on analysis of long-term inspections of the RSFSR sanitary epidemiologic station (SES) radiologic groups (RG) is presented. It reflects optimum organization forms and methods of sanitary inspections of radiological units. A full-scale functioning of the local RGs is an important measure reducing inspection period and increasing its efficiency. 6 refs.

37651 (INIS-SU–82, pp. 98-102) **Hygienic significance of radiostability as measures of adaptive feasibilities.** Kudritskij, Yu.K. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

An attempt is made to substantiate hygienic significance of radiostability analysis as measures of adaptive feasibilities variation under the low dose ionizing radiation effect (IR). Examples of this substantiation are presented. Not only biological radiation effects but social adaptivity problems may be analysed. With more information adaptive feasibilities of human body to radiation factor are extended, its radiostability increases. Analysis of the state of adaptive feasibilities and their development estimation are vital problems of radiation hygiene, the basis for regulation and normalization of radiation factor. 19 refs.

37652 (INIS-SU–82, pp. 114-117) **On improved medical surveillance of personnel operating with radiation sources.** Stepanov, A.I.; Saperov, S.K. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Possibilities of improved medical surveillance of personnel operating with radiation and of population critical groups are shown. Medical surveillance can be improved by organization of mobile clinicodiagnostic laboratories and physical examination on places. Medical board activities can be greatly contributed by sanitary epidemiologic station activity. 4 refs.

37653 (INIS-SU–82, pp. 117-121) **Doses of occupational irradiation of medical personnel of the RSFSR.** Alekseeva, V.A.; Kovalenko, V.I.; Lebedev, O.V. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Annual doses of occupational irradiation of radiologists and roentgenologists of Leningrad and some RSFSR districts are determined and analyzed. Annual average irradiation of radiological personnel of the RSFSR in comparison with UNSCEAR safety standards for other countries are presented. The irradiation doses are shown to be simular. The highest annual average radiation dose is taken by radiological personnel during intracavitary therapy. Analysis of obtained data permitted to bring to light groups of medical personnel and some institutions where improvement of labour conditions can be carried out. 9 refs.; 4 tabs.

37654 (INIS-SU–82, pp. 126-131) **Radiation hygienic characteristic of working conditions and health of women operating in X-ray diagnostic departments.** Liberman, A.N.; Farbtukh, T.A. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

The effect of occupational factors of radiation and nonradiation nature on health of women operating in X-ray diagnostic departments and their progeny is studied. It is shown that present-day radiation and nonradiation effects in X-ray diagnostic departments have no noticeable effect on women health and their reproductive function. But slight changes of some immunological and hematological factors are traced. Results of carried out studies have enabled to depelop and implement methodical recommendations on estimation of working conditions and health of women operating in X-ray diagnostic departments. 14 refs.

37655 (INIS-SU–82, pp. 122-125) **Hygienic characteristic of working conditions and use of some evaluation methods of health of persons subjected to concomitant effect of industrial factors.** Karpov, V.B. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

To study peculiarities of hygienic-occupational effect of low-dose irradiation a comparative evaluation of working conditions and health of persons occupied in exhausting and testing of electron-beam tubes is carried out. Evaluation was based on results of 5-year prophylactic medical examinations and with due account of physiological, hematological and some other factors. To study general condition of people a modernized Dembo-Rubinstein test and specially developed questionnaire of health self-evaluation is used. Along with helth self-evaluation Dembo-Rubinstein test includes helth self- evaluation accounting public complaints. The given investigation methods demonstrated its sufficient informativity and applicabi lity for evaluation of health of persons subjected to concomitan t effect of industrial factors. 1 ref.

37656 (INIS-SU–82, pp. 138-142) **Number of roentgenological procedures per one X-ray examination as quality index roentgenodiagnosis.** Mokrousova, Eh.V.; Yakubovskij-Lipskij, Yu.O. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Number of roentgenological procedures (RLP) per one X-ray examination (XRE) as quality indexes and population dose values per one XRE are presented. They may be used as initial data for qualitative estimation of roentgenodiagnosis and safety standards for human population in the RSFSR administrative ferritories in course of X-ray examination. 1 ref.; 4 tabs.

37657 (INIS-SU–82, pp. 142-145) **Peculiarities of cytogenetic efficiency of irradiation of patients in case of various types of mammography.** Kisel'gof, E.B. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

To attain minimum irradiation of patients during mammography and to choose adequate methods of mammary gland examination biological efficiency of irradiation based on analysis of cytogenetic modifications in peripheral blood lymphocytes in estimated. Cytogenetic methods permit to give an integral estimation of irradiation conditions, thus solving problems on comparative estimation of radiation safety level. Its application is justified in choosing new or modification of existing methods of total X-ray examination of people. 2 tabs.

37658 (INIS-SU–82, pp. 149-153) **Doses from natural sources of ionizing radiations and feasibilities of their restriction.** Krisyuk, Eh.M. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

The data testifying to the fact that the main contribution to the ionizing radiation mean dose for human population is made by natural sources are presented. Problems on restrictions of the population irradiation by natural sources are new for the radiation hygiene. Measures for descreasing the population irradiation by radon and its daughter products in building materials are presented. Feasibility of restricting the people irradiation by natural sources under working conditions are is shown. 13 refs.; 1 tab.

37659 (INIS-SU–82, pp. 161-167) **Equipment and methodical complex for measuring integral volumetrical activity of radon and its fission products.** Terent'ev, M.V.; Nekrasov, E.V.; Koroleva, N.A. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

A prototype of active radiometer for measuring integral valumetric activity of ^{222}Rn is developed. To exclude radon and its fission product penetration to the chamber a silicon rubber membrane is used. The sampler filter ring is replaced with a dielectric track detector in teflon ring holders and AFA-RSA-3 filter. During sampling the radon fission products decay and are detected. After exposure the detector is pickled in NaOH solution for visual examination and track counting. Spark method of track counting is also used. By their features the designed instruments are on a par with the best foreign analogues. 6 refs.

37660 (INIS-SU–82, pp. 131-138) **Actual problems and basic tendencies in radiation protection of patients in X-ray diagnosis.** Nikitin, V.V. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1987. (In Russian). In *Radiation hygiene. Collection of scientific papers.* Order Number DE89012152/JAW. Available from NTIS (US Sales Only), PC A09/MF A01; INIS.

Basic tendencies in optimization of X-ray examinations are presented. One of them is radiation protection of patients by technical re-equipment in roentgenology. The necessity of developing the dynamic system of irradiation standards for all X-ray diagnostic departments aimed at optimizing radiography conditions and decreasing personal and collective radiation doses is shown. It is also necessary to reduce the number of groundless and resultless X-ray diagnosis and reirradiation procedures caused by low quality of X-ray images. 11 refs.

37661 (ORNL/FTR–2880) **[Biospheric model validation in urban, terrestrial, and aquatic environments, Budapest, Hungary, Vienna, Austria, Neuherberg, and Schmallenberg, W. Germany, April 25–May 12, 1988]: Foreign trip report.** Blaylock, B.G.; Hoffman, F.O.; Bartell, S.M. Oak Ridge National Lab., TN (USA). 3 Jun 1988. 25p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89014054/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Drs. Blaylock, Hoffman, and Bartell attended the Sixth Biospheric Model Validation Study (BIOMOVS) meeting in Budapest, Hungary. BIOMOVS is an international cooperative effort to test models designed for calculations of environmental transfer and bioaccumulation of radionuclides and other trace substances. The participants from ORNL served as task group leaders, sessions chairmen, scientific consultants, and contributors to modeling efforts and task discussions at this meeting. BIOMOVS is completing the third year of a 5-year study; many of the tasks assignments are nearing completion, and draft reports are being written. Three final reports were available for distribution. After the BIOMOVS meeting at the invitation of the International Atomic Energy Agency (IAEA), Dr. Hoffman attended a Coordinated Research Program meeting entitled "Model Validation in the Urban, Terrestrial, and Aquatic Environments" and a technical consultants meeting to help formulate plans for the IAEA to continue studies similar to the BIOMOVS effort. Dr. Bartell was invited to Gesellschaft fuer Strahlen-und-Umweltforschung (GSF) in Neuherberg, Federal Republic of Germany, and to Fraunhofer Institut in Schmallenberg, Federal Republic of Germany to present seminars on research concerning current issues in ecological risk analysis.

37662 (PNL–6913) **Calculated and measured depth dose profiles in a phantom exposed to neutron radiation fields.** Scherpelz, R.I.; Tanner, J.E.; Sigalla, L.A.; Hadlock, D.E. Pacific Northwest Lab., Richland, WA (USA). May 1989. 57p. Sponsored by DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Order Number DE89013873/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

An accurate evaluation of doses caused by external sources of neutron radiation depends on knowledge of the transport of radiation inside the human body. Health physicists use two primary methods for studying this radiation transport: computer calculations and measurements. Both computer calculations and measurements were performed under well controlled, nearly identical conditions to determine the extent of their agreement. A comparison of the dose profiles predicted by both measurements and calculations was thus possible. The measurements were performed in a cylindrical phantom made of tissue equivalent plastic. The phantom size, 61 cm high and 30 cm in diameter, was chosen to approximate the human torso and to match the dimensions of cylindrical phantoms used by previous calculations. Holes were drilled down through the phantom to accommodate small tissue equivalent proportional counters (TEPCs) at various depths in the phantom. These counters were used to measure the neutron dose inside the phantom when it was exposed to various sources of neutrons. The holes in the phantom could also accommodate miniature Geiger-Mueller detectors to measure the gamma component of the dose. Neutron and gamma dose profiles were measured for two different sources of neutrons: an unmoderated ^{252}Cf source and a 733-keV neutron beam generated by a Van de Graaff accelerator. 14 refs., 13 figs., 11 tabs.

37663 (PNL-SA–16298) **Radial distributions of energy deposited along charged particle tracks.** Toburen, L.H.; Braby, L.A.; Metting, N.F.; Kraft, G.; Kraske, F.; Schmidt-Boecking, H.; Doerner, R.; Seip, R. Pacific Northwest Lab., Richland, WA (USA). Mar 1989. 13p. Sponsored by DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-890517–4: 10. symposium on microdosimetry, Rome, Italy, 21-26 May 1989). Order Number DE89014448/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Distributions of the specific energy deposited in micron sized volumes have been measured as a function of the radial distance from the path of 5.9-Mev uranium and 13.0- to 17.2-Mev/amu germanium beams. Tissue volumes of 125, 250, 500 and 1000nm diameter were simulated using a wire walled proportional counter capable of 2-dimensional motion relative to the ion beam. Radial distances from 0 to 8000nm were investigated. Values of the mean specific energy were obtained from these distributions and compared to radial dose profiles calculated from track structure models. Excellent agreement is observed between the measured mean specific energy and the calculated radial dose for small distances relative to the track path. 17 refs., 6 figs.

6560 Condensed Matter Physics

Refer also to citation(s) 36367, 36657, 36726, 36898, 36899, 36905, 36955, 36956, 36967, 37097, 37463, 37468, 37477, 37486, 37639, 37746

37664 (DOE/ER/45131–7) **The physics of pattern formation at liquid interface: Progress report, June 1, 1988–May 31, 1989.** Maher, J.V. Pittsburgh Univ., PA (USA). Jun 1989. 11p. Sponsored by DOE Energy Research. DOE Contract FG02-84ER45131. Order Number DE89014527/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes pattern formation at liquid interfaces. Results shed light on questions which underlie the theory of solidification. Also reviewed are random system issues of wetting of curved surfaces and fluctuations in swollen polymeric gel.

37665 **Molecular statics studies of grain boundaries: structure and energy of (001) twist boundaries.** Vitek, V. (Univ. of Pennsylvania, Philadelphia (USA)). pp. 16 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). DOE Contract FG02-84ER45129. (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

While structures and energies of tilt boundaries studied atomistically conform to the common wisdom and, in general, agree with experimental observations, the results of atomistic studies of twist boundaries often appear not to do so. In particular, experimentally well established presence of grain boundary dislocations in (001) twist boundaries [43-47] has not been confirmed by most atomistic calculations [48-50] and results of the X-ray diffraction studies of the structure of the $\Sigma = 5$ boundary disagree with its atomistically calculated structure [48-50]. In this paper they first present calculations of the structures and energies of very long period low coincidence

boundaries the results of which show both localized dislocations and well defined energy cusps. The reasons for previously encountered problems as well as for the unconventional shape of the cusps, are then analyzed. The structure of the $\Sigma = 5$ boundary is then discussed in terms of the structural multiplicity which was proposed to explain the discrepancies with X-ray diffraction data [30]. It is shown here that the possible multiplicity of structures of the $\Sigma = 5$ boundary is even more extensive than previously anticipated and molecular dynamics studies are needed to reveal structures which can be meaningfully compared with experiments.

37666 Pair potential approach for interfaces: fundamental problems and practical solutions. Maggs, A.C. (Cornell Univ., Ithaca, NY (USA)); Ashcroft, N.W. pp. 8 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

A fundamental problem in the use of a central pair-force model for defect problems is that it omits three-body and higher terms which are necessarily present in real systems. Electronic fluctuation effects are also usually omitted. While these can be small in the simple metals, they are significant in noble and transition metals, as shown by a simple real space argument. To gauge the importance of their effects in interface problems, the structure of a simple $\Sigma 5$ twist boundary is examined, with the atoms described by both pair- and three-center interactions and as a function of the relative strength of the two.

37667 Extended CSL-model for grain boundary in layer structures. Kitano, Y. (Hiroshima Univ. (Japan)); Takata, M.; Komura, Y. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The extended CSL-model is applied to structure analysis of boundaries which are observed in high resolution electron microscope (HREM) images between two crystals with two different layer structures. An HREM image for the twist boundary is presented and the CSL-pattern which is predicted by this extension is confirmed. A modification of the Σ-values due to this extension is discussed.

37668 Present limitations on the lattice imaging of grain boundaries. Mader, W. (Max-Planck-Institut fuer Metallforschung, Stuttgart (West Germany)); Necker, G.; Balluffi, R.W. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). DOE Contract FG02-84ER45116. (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Limitations which currently exist on using the electron microscope lattice imaging technique to obtain information about grain boundary structure are considered. Boundaries are only amenable when the adjoining crystals are oriented so that they produce projected patterns of resolved atomic columns or atomic planes. The conditions under which information can then be obtained about the atomistic core structure, the boundary translational state and the presence of localized grain boundary dislocations are described. In a number of instances, ultra-thin bicrystals are required which are so thin that great difficulties will be encountered with utilizing them on a practical basis.

37669 Theory of phase transitions at internal interfaces. Rottman, C. (National Bureau of Standards, Gaithersburg, MD (USA)). pp. 14 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

A variety of phase transitions are possible at internal interfaces. The author will systematically describe from a pedagogical point of view the various classes of phase transitions which are possible. Experiments which have been performed will be mentioned at the appropriate places. Theories which predict these phase transitions and which explain the behavior associated with the transition are emphasized. Possibilities for phase diagrams are suggested. Wetting and melting of internal interfaces will also be discussed.

37670 Grain boundary structure and phase transformations: a critical review of computer simulation studies and comparison with experiments. Pontikis, V. (Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette (France)). pp. 10 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The author presents a review of available computer simulation results on the structure and thermodynamical properties of grain boundaries at temperatures $T > 0.4\ T_{melting}$. The author discusses the possible existence of premelting effects in internal interfaces by comparing the results with the predictions of phenomenological theories of melting and, by analogy, with recent experimental results on surface melting. Experiments on possible premelting effects in grain boundaries indicate that melting of internal interfaces, in the sense of the formation of a macroscopic thick liquid layer inside the boundary, should occur in pure systems only near to the bulk melting point. These computer simulation studies which led to a different conclusion are examined in detail. Large scale computer simulations, additional theoretical work and more precise experiments are needed to clarify this point.

37671 Two dimensional phase equilibria at surfaces. Blakely, J.M. (Cornell Univ., Ithaca, NY (USA)). pp. 16 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

This paper provides a brief discussion of some current experimental work on phase transitions at free surfaces. Examples are used to illustrate work in the areas of surface reconstruction, roughening, atomic step coalescence, and transformations of adsorbed and segregated layers. All of these surface phenomena are likely to have counterparts at internal boundaries.

37672 Molecular dynamics study of high-temperature grain-boundary stability in a (100) $\Sigma = 29$ bicrystal model. Nguyen, T. (Argonne National Lab., IL (USA)); Yip, S.; Wolf, D. pp. 6 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). DOE Contract W-31-109-ENG-38. (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

A new molecular dynamics program for the investigation of planar bicrystalline interfaces at high temperature and finite external stress has been developed. The constant-stress (Parrinello-Rahman) method is combined with a Region I-Region II treatment of the borders, thus avoiding (i) 3d-periodic border conditions (and therefore the presence of two interfaces in the computational unit cell) and (ii) unphysical constraints arising from fixed borders. The usefulness of this new semi-periodic border treatment is illustrated in an investigation of the high-temperature stability and structure of the $\Sigma = 29$ (100) twist grain boundary.

37673 Mobility of dislocations in grain boundaries. Grabski, M.W. (Warsaw Univ. of Technology (Poland)). pp. 10 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The mobility of grain boundary (GB) dislocations is discussed in terms of the dissociation of lattice dislocations into extrinsic GB dislocations and subsequent spreading of the dissociation products along the boundary plane. The kinetics of spreading is analyzed and compared with the experimental evidence. It is shown that the motion of EGBDs is controlled by the GB diffusion and is a definite, characteristic property of an individual interface. The new experimental results related to the dependence of spreading kinetics on a GB structure and chemical composition are analyzed both from the point of view of its influence on the GB processes and of its utilization for the determination of the distribution function of GB character.

Activation of the spreading process is responsible for many GB dependent phenomena of engineering importance, especially in the range of intermediate temperatures. The possible ways of exploiting the data concerning spreading in the design of GBs are shown.

37674 Grain boundary design for desirable mechanical properties. Watanabe, T. (Tohoku Univ., Sendai (Japan)). pp. 14 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

Grain boundary design for desirable mechanical properties of polycrystalline materials is discussed on the basis of the intrinsic structure-dependent mechanical properties, particularly deformation and fracture of grain boundaries. The importance of the grain boundary character distribution (GBCD) is emphasized which is a new microstructural parameter controlling the properties of polycrystals. The results of recent studies of GBCD are presented. The potential for grain boundary design for strong and ductile polycrystals through the control of GBCD and boundary inclination is discussed.

37675 Interface crack models. Suga, T. (Max-Planck-Institut fuer Metallforschung, Stuttgart (West Germany)); Schmauder, S.; Elssner, G. pp. 7 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The continuum models for an interface crack are reviewed. The logical inconsistencies present in the local stress field of the conventional model, such as the oscillatory singularities and the interpenetration of the crack surfaces, are removed by modifying the boundary conditions at the crack tip. An interpretation of the crack tip models is given and discussed with respect to inelastic energy dissipation during interfacial failure of heterogeneous materials.

37676 Controlling embrittlement at grain boundaries in intermetallic compounds. Takasugi, T. (Tohoku Univ., Sendai (Japan)). pp. 12 of Interface science and engineering '87. Les Editions de Physique, Les Ulis Cedex, France (1988). (CONF-870793–: Interface science and engineering '87: international conference on the structure and properties of internal interfaces, Lake Placid, New York, USA, 13-16 Jul 1987).

The present paper first presents some characteristics of structure and electronic (bond) nature for the grain boundary brittleness of the intermetallic compounds. Next, the phenomenological aspects for the grain boundary brittleness of the $L1_2$-type intermetallic compounds are reviewed with respect to the combination of the constituent atoms, the alloying effect, the stoichiometry effect, and the role of impurity or gaseous atoms. It is emphasized that the brittleness of grain boundaries in the intermetallic compounds are intimately related to the atomistic and electronic structures at grain boundary regions. Based on these systematic observations, it is suggested that the brittleness of the $L1_2$-type intermetallic compounds can be manipulated by appropriate control of composition and the corresponding electrochemical bond environment at grain boundary planes, and by control of the test environment. Finally, some instances pointing to the materials development are described.

37677 (INIS-mf–11396, pp. 81) **TDPAD measurements of implantation temperature dependance in ^{19}F implanted diamond.** Conell, S. (Wits-CSIR Schonland Research Centre for Nuclear Sciences, University of the Witwatersrand, Johannesburg (South Africa)); Sellschop, J.P.F.; Stemmet, M.S.; Appel, H.; Bharuth-Ram, K. South African Inst. of Physics, Faure (South Africa). 1987. (CONF-8707216–: 32. Annual conference of the South African Institute of Physics, Durban, South Africa, 13-17 Jul 1987). In *32nd Annual conference and the 22nd annual theoretical seminar of the South African Institute of Physics.* Order Number DE89615754/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

This publication contains only the abstracts of seminars.

DIAMONDS/fluorine 19; DIAMONDS/ion implantation; ANGULAR DISTRIBUTION; DIAMONDS; HIGH TEMPERATURE; KEV RANGE 100-1000

37678 (INIS-mf–11456) **Ninth conference of Czechoslovak physicists. Part 1, 2.** Kosek, F.; Cimpl, Z.; Pantoflicek, J. (eds.). Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia). 1987. 517p. (In Czech, Slovak). (CONF-8707217–: 9. conference of Czechoslovak physicists, Pardubice, Czechoslovakia, 6-10 Jul 1987). Order Number DE89617602/JAW. Available from NTIS (US Sales Only), PC A22/MF A01 - OSTI; INIS.

The two volume proceedings contain papers and posters presented at the symposium. A total of 21 papers have been incorporated in INIS. The subject areas of the papers included: problems of the neutrino physics, new ideas of space-time and particles, the Czechoslovak project of the source of synchronous radiation, thermonuclear reaction, the study of amorphous substances using the EXAFS (Extended X-ray Absorption Fine Structure) method, electron structure and the magnetism of 5f systems, hyperfine interaction in substituted YIG's (Yttrium Iron Garnets), Moessbauer spectroscopy of amorphous substances, superliquid phase of ^3He, results attained in subnuclear and nuclear physics. (J.P.).

37679 (INIS-SU–89) **7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.** AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. 211p. (In Russian). Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

Individual papers in these proceedings are separately indexed.

37680 (INIS-SU–89, pp. 149-150) **Cross-luminescence is a method of rare earth element electron structure investigation and physical base for subnanosecond scintillator operation.** Valbis, Ya.A. (Latvijskij Gosudarstvennyj Univ., Riga. (USSR). Nauchno-Issledovatel'skij Inst. Fiziki Tverdogo Tela); Rachko, Z.A.; Yansons, Ya.L. AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya. 1988. (In Russian). In *7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports.* Order Number DE89012153/JAW. Available from NTIS (US Sales Only), PC A10/MF A01; INIS.

CESIUM BROMIDES/radioluminescence; CESIUM CHLORIDES/radioluminescence; CESIUM FLUORIDES/radioluminescence; RUBIDIUM FLUORIDES/radioluminescence; RADIOLUMINESCENCE; CRYSTALS; ELECTRONIC STRUCTURE; ENERGY-LEVEL TRANSITIONS; LINE WIDTHS

37681 (INIS-SU–94/A, pp. 19-21) **Clasterization of isoelectronic tellurium addition in $ZnS_{1-x}Te_x$ solid solution.** Akhekyan, A.M.; Kozlovskij, V.I. AN SSSR, Moscow (USSR). Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics.* Order Number DE89012156/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Kratkie soobshcheniya po fizike.; no. 8.

Cathodoluminescence characteristics of the $ZnS_{1-x}Te_x$ solid solution depending on the temperature of crystal annealing are investigated. Experimental data obtained are interpreted on the basis of cluster representation about the distribution of solid solution components. 5 refs.; 1 fig.; 1 tab.

37682 (IPNO-DRE–88-09) **Multiple angular scattering of heavy ions $^{16-17}O$, ^{40}Ar, ^{86}Kr, ^{100}Mo at intermediate energies (20-90 MeV/u).** Anne, R.; Bastin, G. Paris-11 Univ., 91 - Orsay; Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse); Hubert, F.; Herault, J.; Bimbot, R.; Gauvin, H. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1988. 46p. Order Number DE89789221/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

An original experimental method has been developed using the LISE magnetic spectrometer at the GANIL accelerator for measuring the angular distributions of heavy ions at the exit of targets. Multiple angular scattering of heavy ions $^{16-17}O$, ^{40}Ar, ^{86}Kr, ^{100}Mo in solid and gaseous media have thus been measured in the energy range 20-90 MeV/u. With these different projectile-target systems and incident energies the Born parameter α_B takes values in a wide range (0.5 to 100). The experimental results hae thus been compared to multiple scattering theories based on classical or quantum mechanical calculations. As far as the classical theory is concerned an "universal" relation links the reduced straggling angle $\alpha_{1/2}$ and

the reduced thickness tau introduced by Meyer according to the expression $\alpha_{1/2} = 1.00\ tau^{0.55}$. In the framework of the quantal Moliere theory a good agreement is found with experiment when α_B is approximately unity. Increasing deviations are observed when this parameter increases up to 100.

37683 (KURRI-TR–302, pp. 36-39) **Trends in research of ion beam application.** Odomari, Iwao (Waseda Univ., Tokyo (Japan). School of Science and Engineering). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. May 1988. (In Japanese). (CONF-8707203–: Specialist research meeting on semiconductors with research reactors; Specialist research meeting on semiconductors with research reactors, Kyoto, Japan; KUMATORI, Japan, 27 Jul 1987; 18 jan 1988;CONF-8801165–). In *Proceedings of the specialist research meetings on semiconductors with research reactors.* Order Number DE89003365/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

ION BEAMS/uses; USES; SURFACE TREATMENTS; SURFACE PROPERTIES; RUTHERFORD SCATTERING; NUCLEAR REACTION ANALYSIS; ION MICROPROBE ANALYSIS; ION IMPLANTATION; PIXE ANALYSIS

37684 (KURRI-TR–302, pp. 40-43) **Ion beam applications in MeV region.** Masuda, Kohzoh (Tsukuba Univ., Tsukuba, Ibaraki (Japan)). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. May 1988. (In Japanese). (CONF-8707203–: Specialist research meeting on semiconductors with research reactors; Specialist research meeting on semiconductors with research reactors, Kyoto, Japan; KUMATORI, Japan, 27 Jul 1987; 18 jan 1988;CONF-8801165–). In *Proceedings of the specialist research meetings on semiconductors with research reactors.* Order Number DE89003365/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

ION BEAMS/uses; ION BEAMS/mev range; USES; ION SCATTERING ANALYSIS; RUTHERFORD SCATTERING; BACKSCATTERING; ION IMPLANTATION; LET

37685 (LA-UR–89-1462) **Modeling of non-structural contribution to the pattern.** Von Dreele, R.B. Los Alamos National Lab., NM (USA). 1989. 15p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890771–2: American Crystallographic Association annual meeting, Seattle, Washington, USA, 23-29 Jul 1989). Order Number DE89011164/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Rietveld refinement technique requires that sensible models be chosen for both the Bragg reflection profiles and intensities as well as the background contribution. The reflection profiles contain an instrumental part and a sample dependent part that is affected by particle size and strain. The intensities are affected by geometric factors peculiar to the diffraction method and sample dependent effects such as absorption, extinction and preferred orientation. The various functions used for these effects in Rietveld refinement will be discussed along with the possible interpretation of their coefficients. 19 refs., 3 figs.

37686 (LA-UR–89-1967) **Foil implosion studies on PEGASUS.** Cochrane, J.C.; Bartsch, R.R.; Begay, F.; Kruse, H.W.; Oona, H.; Parker, J.V.; Turchi, P.J. Los Alamos National Lab., NM (USA). 1989. 3p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890665–28: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, CA, USA, 12-14 Jun 1989). Order Number DE89014255/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

PEGASUS is a 1.5 MJ capacitor bank facility used in the Los Alamos Trailmaster foil implosion program. The experiments on this facility are to serve as a diagnostic testbed and foil physics benchmark for foil implosions with explosive generators as drivers. During the first year of operation, foil implosions have been driven by discharging the bank directly into a very thin Aluminum 2500 Å thick free-standing foil without any pulse sharpening techniques; so-called "direct drive."These direct drive experiments have served as initial tests to optimize bank performance and foil implosion experimental techniques. The results to date are presented below. 1 ref., 2 figs.

37687 (LA-UR–89-2162) **Competing interactions and complexity in condensed matter.** Bishop, A.R. Los Alamos National Lab., NM (USA). 1989. 39p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8903141–1: NATO ISI partially integrable systems, Les Houches, France, Mar 1989). Order Number DE89014285/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

Some major themes of space-time complexity in condensed matter contexts are reviewed. They are illustrated through model and physical systems, analysed by both analytical and numerical techniques. 40 refs., 13 figs.

37688 (MLM–3951(OP)) **An Auger sputter profiling study of nitrogen and oxygen ion implantation in two titanium alloys.** Barton, B.D.; Pope, L.E.; Wittberg, T.N. EG and G Mound Applied Technologies, Miamisburg, OH (USA). 1989. 33p. Sponsored by DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-8905167–1: 11. symposium on applied surface analysis, Cleveland, Ohio, USA, 31 May - 2 jun 1989). Order Number DE89014734/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Samples of two titanium alloys, Ti-6Al-4V and Ti-15V-3Cr-3Sn-3Al, were ion implanted with a combination of nitrogen (N+) and oxygen (O+). For each alloy, implantation parameters were chosen to give implanted nitrogen concentrations of approximately 10 or 50 atomic percent, from a depth of 100 nanometers to a depth of 400 nanometers. In all but one case, dual energy (200 keV and 90 keV) implantations of nitrogen were used to give a relatively uniform nitrogen concentration to a depth of 300 nanometers. In each case, oxygen was implanted at 35 keV, following the nitrogen implantation, to give an oxygen-enriched region near the surface. The implanted samples were then examined by Auger electron spectroscopy (AES) combined with argon ion sputtering. In order to determine the stoichiometry of the nitrogen implanted regions, it was necessary to determine the N(KVV) contribution to the overlapping N(KVV) and Ti(LMM) Auger transitions. It was also necessary to correct for the ion-bombardment-induced compositional changes which have been described in an earlier study titanium nitride thin films. The corrected AES depth profiles were in good agreement with theoretical predictions. 18 refs., 6 figs., 2 tabs.

37689 (SAND–89-0542C) **Phonon-drag thermoelectric power in high magnetic fields in heterojunctions.** Lyo, S.K. Sandia National Labs., Albuquerque, NM (USA). 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890746–1: 4. international conference on modulated semiconductor structures, Ann Arbor, MI, USA, 17-21 Jul 1989). Order Number DE89013921/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A theory is presented for the low-temperature (T) phonon-drag thermopower S_{xx} in a semiconductor heterojunction in a strong magnetic field. Gigantic quantum oscillations (much larger than electron-diffusion contributions) are obtained. When the Landau-level width is larger than k_BT, the one-phonon intra-Landau-level absorption and emission processes are dominant. In the opposite limit, the two-phonon Raman processes give major contributions. The temperature and field dependences of S_{xx} agree reasonably with recent data in $GaAs/Al_xGa_{1-x}As$ heterojunctions. Effects of localized states on S_{xx} are discussed. 14 refs., 3 figs.

37690 (SAND–89-1346C) **Scattering from fractals.** Hurd, A.J. Sandia National Labs., Albuquerque, NM (USA). 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890791–1: NSF workshop on future directions in electromagnetics research, Boston, MA, USA, 25-27 Jul 1989). Order Number DE89013451/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The realization that structures in Nature often can be described by Mandelbrot's "fractals" has led to a revolution in many areas of physics. The interaction of waves with fractal systems has, understandably, become intensely studied since scattering is the method of choice to probe delicate fractal structures such as chainlike particle aggregates. Not all of these waves are electromagnetic: neutron scattering, for example, is an important complementary tool to structural studies by x-ray and light scattering. Since the phenomenology of small-angle neutron scattering (SANS), as it is applied to fractal systems, is identical to that of small-angle x-ray scattering (SAXS), it falls within the scope of this Working Paper. 9 refs.

37691 Fragmentation and structure of silicon microclusters. Feuston, B.P. (Argonne National Lab., IL (USA)); Kalia, R.K.; Vashishta, P. pp. 14 of Condensed matter theories. Volume 2. Vashishta, P.; Kalia, R.K.; Bishop, R.F. (eds.) Plenum Press, New York, NY (1987). (CONF-860789–: 10. international workshop on condensed matter theories, Argonne, Illinois, USA, 21-26 Jul 1986).

It may be possible to determine the magic numbers and fragmentation spectra from the ground-state binding energies and structure, but the relationship between the lowest-energy zero-temperature configurations and the energetics of finite-temperature microclusters is not obvious. Recall fragmentation of Si clusters occurs at temperatures the order of the melting temperature ($T \approx 2000$ K). What is needed, a first-principles finite-temperature calculation, allowing the determination of all possible structures, their corresponding binding energies, and fragmentation spectra, is not presently possible. However, a molecular dynamics calculation does allow one to study the nature of fragmentation in addition to determination of the global ground-state structure and all mechanically stable configurations underlying the finite-temperature cluster, once given an interaction potential. The authors present results for such a calculation for Si_{2-14} using the Stillinger-Weber 3-body potential. Their results indicate that the existence of magic numbers is determined by the topology and energetics of high-energy bound structures rather than the structure and ground-state energies at zero temperature.

37692 Computer simulation of special grain boundaries in metals and ionic materials. Wolf, D. (Argonne National Lab., IL (USA)). pp. 8 of Condensed matter theories. Volume 2. Vashishta, P.; Kalia, R.K.; Bishop, R.F. (eds.) Plenum Press, New York, NY (1987). DOE Contract W-31-109-ENG-38. (CONF-860789–: 10. international workshop on condensed matter theories, Argonne, Illinois, USA, 21-26 Jul 1986).

In recent years a set of lattice statics computer codes has been developed which permits one to determine the energies, structures, and point-defect properties of grain boundaries in metals and predominantly ionic ceramic materials. In contrast to metals, long-range Coulomb forces between the ions have to be considered in ionic bicrystals. The selection criteria for the identification of special (i.e., low-energy) grain boundaries (GBs) is discussed with particular emphasis on (a) the role of the GB plane, (b) the influence of the planar unit-cell area, and (c) the effect of the interatomic potential on the predicted energies and structures of GBs in metals and ionic materials.

37693 Density functional theory and f electron systems. Norman, M.R. (Argonne National Lab., IL (USA)). pp. 8 of Condensed matter theories. Volume 2. Vashishta, P.; Kalia, R.K.; Bishop, R.F. (eds.) Plenum Press, New York, NY (1987). DOE Contract W-31-109-ENG-38. (CONF-860789–: 10. international workshop on condensed matter theories, Argonne, Illinois, USA, 21-26 Jul 1986).

Density functional theory within the local density approximation has proven to be an extremely successful way to elucidate the electronic structure and ground state properties of a wide variety of electronic systems. Because of the discovery of exotic behavior in f electron systems such as the mixed valent effect and heavy fermion phenomenon, the applicability of the above theory has been questioned. Recently, dramatic progress has been made in determining more exact density functionals which have been extensively tested in atomic systems. The purpose of this paper is to speculate what impact these new methods will have on the f electron question. In the first section, a brief review of density functional theory and the local density approximation (LDA) is given, as well as an equally brief review of results on f electron solids. In the second section, the new density functional techniques are discussed and results for atoms reviewed, and potential extension of these methods to the case of the lattice, with emphasis on f electron solids is presented.

37694 Electron localization in one-dimensional incommensurate potentials. Luban, M. (Iowa State Univ., Ames (USA)). pp. 10 of Condensed matter theories. Volume 2. Vashishta, P.; Kalia, R.K.; Bishop, R.F. (eds.) Plenum Press, New York, NY (1987). DOE Contract W-7405-ENG-82. (CONF-860789–: 10. international workshop on condensed matter theories, Argonne, Illinois, USA, 21-26 Jul 1986).

A one-dimensional potential V(x) consisting of two periodic components whose periods are incommensurate can give rise to localized electron states. Conventional numerical methods to calculate the localized eigen-states, either of the Schrodinger equation or the tight-binding models (TBM), are plagued by a numerical instability originating in a second solution which diverges for {vert ba} x {vert ba} $\rightarrow \infty$. The authors present a practical numerical algorithm for an arbitrary TBM which is free of this difficulty and which provides the localized eigenstates and their energies to ultra-high precision. The underlying method incorporates a generalization of a classic theorem of Pincherele for the existence of minimal solutions to three-term recurrence relations. They present numerical results for the Aubry model for $\Delta > 1$, where $\Delta = V_I / (2V_H)$ is a dimensionless coupling constant, V_I is the strength of the incommensurate component of the one-electron potential and V_H is the nearest-neighbor hopping matrix element. They propose that the well-known transition from localized to extended eigenstates which occurs as Δ is reduced towards unity is accompanied by an incipient infinite degeneracy of the localized states. Their numerical results for the energy difference of any pair of nearly-degenerate localized states is well described by a power law, $(\Delta\text{-}1)^Y$, but with a non-universal exponent Y.

37695 Transport in metal alloys and resistivity saturation. Swihart, J.C. (Indiana Univ., Bloomington (USA)); Butler, W.H. pp. 12 of Condensed matter theories. Volume 2. Vashishta, P.; Kalia, R.K.; Bishop, R.F. (eds.) Plenum Press, New York, NY (1987). DOE Contract AC05-84OR21400. (CONF-860789–: 10. international workshop on condensed matter theories, Argonne, Illinois, USA, 21-26 Jul 1986).

The authors consider two problems in the electrical resistivity of metals and alloys. These consist of the residual resistivity of random substitutional alloys as a function of composition and the phenomenon of resistivity saturation in metals and alloys. They present a unified treatment that covers both phenomena with one model. This model was first presented by Butler and is based on the Korringa-Kohn-Rostocker band structure method blended with the Coherent-Potential-Approximation.

37696 What underlies the Anderson Hamiltonian?. Koelling, D.D. (Argonne National Lab., IL (USA)). pp. 10 of Condensed matter theories. Volume 2. Vashishta, P.; Kalia, R.K.; Bishop, R.F. (eds.) Plenum Press, New York, NY (1987). DOE Contract W-31-109-ENG-38. (CONF-860789–: 10. international workshop on condensed matter theories, Argonne, Illinois, USA, 21-26 Jul 1986).

The Anderson Hamiltonian characterizes a model in which local orbitals interact with each other through Coulomb interactions and with a bath of itinerant states through hybridization. It has been utilized with considerable success to discuss phenomena ranging from the Kondo problem to the occurrence of two peaks in the photoemission spectra of Ce compounds. Normally, it is studied by examining the content of its solutions. Of comparable significance, however, is the determination of the various parameters of the model. In trying to find a prescription for the parameters of the model, one simultaneously develops some understanding of the states involved and studies whether the model incorporates enough of the essential physics. One useful tactic is to compare this model with other models and ask how different effects are accommodated. The author compares results from the model with atomic, band, and modified band calculations for f-electron materials.

37697 Binding energy of large icosahedral and cuboctahedral Lennard-Jones clusters. Northby, J.A. (Rhode Island Univ., Kingston (USA). Dept. of Physics); Xie, J.; Freeman, D.L.; Doll, J.D. *Zeitschrift fuer Physik D: Atoms, Molecules and Clusters (F.R. Germany)*, 12(1-4): 69-71 (Jun 1989). (CONF-8807155–: 4. international symposium on small particles and inorganic clusters (ISSPIC-4), Aix-en-Province, France, 5-9 Jul 1988).

It is widely believed that the lowest energy configurations for small rare gas clusters have icosahedral symmetry. This contrasts with the bulk crystal structures which have cuboctahedral fcc symmetry. It is of interest to understand the transition between this finite and bulk behavior. To model this transition in rare gas clusters we have undertaken optimization studies within the Lennard-Jones pair potential model. Using a combination of Monte Carlo and Partan Search optimization methods, the lowest energy relaxed structures of Lennard-Jones clusters having icosahedral and cuboctahedral

symmetry were found. Studies were performed for complete shell clusters ranging in size from one shell having 13 atoms to 14 shells having 10,179 atoms. It was found that the icosahedral structures are lower in energy than the cuboctahedral structures for cluster sizes having 13 shells or fewer. Additional studies were performed using the more accurate Aziz-Chen [HFD-C] pair potential parameterized for argon. The conclusions appear to be relatively insensitive to the form of the potential.

6561 Superconductivity

Refer also to citation(s) 36640, 36641, 36642, 36649, 36653, 36654, 36897, 36898, 36901, 36902, 36903, 36908, 36912, 36913, 36924, 36926, 36928, 36941, 36944, 36945, 36947, 36949, 36950, 36952, 36953, 36954, 36956

37698 (SAND–89-1496C) **Formation, motion and high temperature superconductivity of large bipolarons.** Emin, D. Sandia National Labs., Albuquerque, NM (USA). 1989. 6p. Sponsored by DOE Energy Research. DOE Contract AC04-76DP00789. (CONF-890718–1: International conference on materials and mechanisms of superconductivity - high-temperature superconductors, Stanford, California, USA, 23-28 Jul 1989). Order Number DE89014630/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Bipolaronic superconductivity requires two exceptional circumstances. First, at least some charge carriers must form bipolarons. Second, these bipolarons must be mobile (move coherently). However, beyond quasi-one-dimensional electronic systems, bipolarons have heretofore always been found to be "small." Small (bi)polarons are very compact (bi)polarons that localize rather than move coherently. Thus, small bipolarons are not suitable carriers for bipolaronic superconductivity. However, in analogy with the case of large polarons, less compact bipolarons, "large" bipolarons, are expected to be mobile. These observations lead one to ask if and when large bipolarons can form in multi-dimensional electronic systems. Here the results of studies of the formation, motion and superconductivity of large bipolarons are summarized. 5 refs.

6570 Theoretical and Mathematical Physics

Refer also to citation(s) 37548, 37637, 37693, 37694, 37696

37699 (IC–88/392) **Local structure of a 2-codimensional conformally flat submanifold in an Euclidean space R^{n+2}.** Zafindratafa, G. International Centre for Theoretical Physics, Trieste (Italy). Dec 1988. 27p. Order Number DE89618379/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Since 1917, many mathematicians studied conformally flat submanifolds. In 1917, E. Cartan showed that the second fundamental form of a conformally flat hypersurface of R^{n+1} admits an eigenvalue of multiplicity $\geq$ n-1. In 1972, B.Y. Chen introduced the notion of quasiumbilical submanifold. A submanifold M of codimension N in R^{n+N} is quasiumbilical if and only if there exists, locally at each point of M, an orthonormal frame field $(\xi_1,...,\xi_N)$ of the normal space so that the Weingarten tensor of each ξ_α possesses an eigenvalue of multiplicity $\geq$ n-1. The purpose of this work is to resolve the following problem: Is there any equivalent definition of quasiumbilicity which does not use either any local frame field on the normal bundle or any particular sections on the tangent bundle? B.Y. Chen and K. Yano proved in 1972 that a quasiumbilical submanifold of codimension $N \geq 1$ in R^{n+N} is conformally flat; moreover in the case of codimension N=1, the notion of quasiumbilicity is equivalent to the conformal flatness. J.D. Moore and J.M. Morvan improved this last equivalence in 1978 by proving that, if $1 \leq N \leq \inf(4,n-3)$, a N-codimensional submanifold of R^{n+N} is conformally flat if and only if it is quasiumbilical. But two years before, B.Y. Chen and L. Verstraelen demonstrated that any N-codimensional conformally flat submanifold of R^{n+N} ($1 \leq N \leq n-3$) with a null normal curvature is quasiumbilical. In 1985, M. do Carmo and his coworkers determined the local geometry of a conformally flat hypersurface of R^{n+1}. The purpose of this work is to generalize M. do Carmo's result.

37700 (IC–88/398) **Compactifications of the eleven-dimensional supermembrane.** Bergshoeff, E.; Duff, M.J.; Pope, C.N.; Sezgin, E. International Centre for Theoretical Physics, Trieste (Italy). Dec 1988. 13p. (CTP-TAMU–76/8). Order Number DE89611965/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We construct new vacua for the eleven-dimensional supermembrane in which spacetime is the product of four-dimensional anti-de Sitter space and a compact seven-dimensional Einstein space, and the membrane is a sphere of non-zero radius in the anti-de Sitter space. In one class of solution the radius is a specific multiple of the anti-de Sitter scale parameter while in a second class the radius is arbitrary. Remarkably, only two of the Freund-Rubin compactifications admit vacua of the latter class: the round seven-sphere with N=8 supersymmetry and the N(0,1) space with N=3 supersymmetry. (author). 27 refs.

37701 (INIS-mf–11440, pp. 217) **Minuscule weights and Kronecker products.** Iosifescu, M. (Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering); Scutaru, H. Central Inst. of Physics, Bucharest (Romania). 1988. (In Romanian). (CONF-8810372–: Advances in physics, Constanta, Romania, 6-8 Oct 1988). In *Advances in Physics.* Order Number DE89012158/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

For minuscule weight representations of the semisimple Lie algebras the weight diagrams and the Kronecker products with arbitrary irreducible representations are determinated. (authors).

37702 (JINR-D–17-88-95) **4. International symposium on selected topics in statistical mechanics.** Joint Inst. for Nuclear Research, Dubna (USSR). 1988. 499p. (In Russian). (CONF-8708341–: 4. International symposium on selected topics in statistical mechanics, Dubna, USSR, 25-29 Aug 1987). Order Number DE89012150/JAW. Available from NTIS (US Sales Only), PC A21/MF A01.

Individual papers in these proceedings are indexed separately.

37703 (JINR-D–17-88-95, pp. 24-29) **Bose gas with two- and three-particle interaction: evolution of soliton-like bubbles.** Barashenkov, I.V.; Kholmurodov, Kh.T. Joint Inst. for Nuclear Research, Dubna (USSR). 1988. (In Russian). (CONF-8708341–: 4. International symposium on selected topics in statistical mechanics, Dubna, USSR, 25-29 Aug 1987). In *4. International symposium on selected topics in statistical mechanics.* Order Number DE89012150/JAW. Available from NTIS (US Sales Only), PC A21/MF A01; INIS.

Solutions of the non-linear Schroedinger equation (NSE) for the Bose gas with two- and three-particle interaction are considered. Problems of soliton-like bubble existence, stability and evolution of the moving soliton are studied. It is shown that at D=2.3 for low-amplitude waves propagating at the transonic velocity the NSE is reduced to a two- and three-dimensional Kadomtsev-Petviashvili (KP) equation and the NSE bubble soliton transfers to the KP one. 9 refs.; 2 figs.

37704 (JINR-D–17-88-95, pp. 38-46) **Quantum random processes and kinetic equations of multi-quantum systems.** Belavkin, V.P. (Moskovskij Inst. Ehlektronnogo Mashinostroeniya, Moscow (USSR)); Maslov, V.P. Joint Inst. for Nuclear Research, Dubna (USSR). 1988. (CONF-8708341–: 4. International symposium on selected topics in statistical mechanics, Dubna, USSR, 25-29 Aug 1987). In *4. International symposium on selected topics in statistical mechanics.* Order Number DE89012150/JAW. Available from NTIS (US Sales Only), PC A21/MF A01; INIS.

The report deals with Markovian semi-group dynamics of an open system of a large number of quantum particles of different types which interact between each other and with thermostat. It is shown how to obtain nonlinear one-particle kinetic equations under assumption of weak interaction and a large number of particles in mean field approximation. 8 refs.

37705 (JINR-R–4-88-532) **Adiabatic representation of scattering problem in three-body quantum system.** Vinitskij, S.I.; Dubovik, V.M.; Markovskij, B.L.; Kadomtsev, M.B.; Suz'ko, A.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1988. 18p. (In Russian). Order Number DE89618406/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Submitted to J. Phys., G.

In the configuration space of the three charged bodies relative motion new adiabatic representation of the wave function (psi(X)) is suggested in terms of the local adiabatic expansion of the Faddeev components. Using this representation an adiabatic formulation of the multichannel three-particle-scattering problem for bounded and fastly decreasing pair potentials is correctly performed. 12 refs.; 2 figs.

37706 (LAL–88-33) **Study of atmospheric neutrino interactions with the Frejus detector.** Longuemare, C.; Frejus Collaboration. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Jun 1988. 11p. (CONF-8804184–: 9. workshop on grand unification, Aix-Les-Bains, France, 27-30 Apr 1988). Order Number DE89776425/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

A detailed analysis of the 165 neutrino events collected in the Frejus detector during three years of running is presented. This sample, which corresponds to a 1.3 kt.year sensitivity, is compared to the predictions of a neutrino Monte Carlo simulation program based on a calculated atmospheric neutrino flux. The agreement is satisfactory at the present statistical level.

37707 (LAL–88-34) **Results of the Frejus experiment on nucleon decay.** Bourdarios, G.; Frejus Collaboration. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Jun 1988. 8p. (CONF-8804184–: 9. workshop on grand unification, Aix-Les-Bains, France, 27-30 Apr 1988). Order Number DE89776421/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

The Frejus detector has reached an integrated fiducial sensitivity of 1.4 kt.year. The data provide no evidence for nucleon decay, the number of selected events being consistent with the expected background due to atmospheric neutrino interactions. The lower lifetime limits obtained range from 0.9 10^{31} to 2.9 10^{31} years for the modes with a missing anti-neutrino in the final state, and from 0.8 10^{31} to 5.1 10^{31} years for the modes with one charged lepton in the final state.

37708 (LA-UR–89-1745) **Quantum mechanical stabilization of Minkowski signature wormholes.** Visser, M. Los Alamos National Lab., NM (USA). 19 May 1989. 10p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8905153–1: WORMSHOP '89, Batavia, Illinois, USA, 11-13 May 1989). Order Number DE89013436/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

When one attempts to construct classical wormholes in Minkowski signature Lorentzian spacetimes violations of both the weak energy hypothesis and averaged weak energy hypothesis are encountered. Since the weak energy hypothesis is experimentally known to be violated quantum mechanically, this suggests that a quantum mechanical analysis of Minkowski signature wormholes is in order. In this note I perform a minisuperspace analysis of a simple class of Minkowski signature wormholes. By solving the Wheeler-de Witt equation for pure Einstein gravity on this minisuperspace the quantum mechanical wave function of the wormhole is obtained in closed form. The wormhole is shown to be quantum mechanically stabilized with an average radius of order the Planck length. 8 refs.

37709 (LBL–25609) **Canonical integration and analysis of periodic maps using non-standard analysis and lie methods.** Forest, E.; Berz, M. Lawrence Berkeley Lab., CA (USA). Jun 1988. 22p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8807177–1: 2. workshop on LIE methods in optics, Morelos, Mexico, 19-22 Jul 1988;ESG–46). Order Number DE89013369/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We describe a method and a way of thinking which is ideally suited for the study of systems represented by canonical integrators. Starting with the continuous description provided by the Hamiltonians, we replace it by a succession of preferably canonical maps. The power series representation of these maps can be extracted with a computer implementation of the tools of Non-Standard Analysis and analyzed by the same tools. For a nearly integrable system, we can define a Floquet ring in a way consistent with our needs. Using the finite time maps, the Floquet ring is defined only at the locations s_i where one perturbs or observes the phase space. At most the total number of locations is equal to the total number of steps of our integrator. We can also produce pseudo-Hamiltonians which describe the motion induced by these maps. 15 refs., 1 fig.

37710 (SFB–237-46(prepr.)) **Klein's paradox and the relativistic point interaction.** Seba, P. Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen; Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS); Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. Mar 1989. 20p. Available from Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen.

We discuss a short-range approximation to relativistic delta-function potentials.

37711 **Wormholes and the cosmological constant.** Klebanov, I. (Stanford Linear Accelerator Center, CA (USA)); Susskind, L.; Banks, T. *Nuclear Physics [Section] B (Netherlands)*, 317(3): 665-692 (8 May 1989). DOE Contract AC03-76SF00515.

We review Coleman's wormhole mechanism for the vanishing of the cosmological constant. We show that in a minisuperspace model wormhole-connected universes dominate the path integral. We also provide evidence that the euclidean path integral over geometries with spherical topology is unstable with respect to formation of infinitely many wormhole-connected 4-spheres. Consistency is restored by summing over all topologies, which leads to Coleman's result. Coleman's argument for determination of other parameters is reviewed and applied to the mass of the pion. A discouraging result is found that the pion mass is driven to zero. We also consider qualitatively the implications of the wormhole theory for cosmology. We argue that a small number of universes containing matter and energy may exist in contact with infinitely many cold and empty universes. Contact with the cold universes insures that the cosmological constant in the warm ones is zero.

70 FUSION ENERGY

37712 (INIS-SU–86/A) **Thermonuclear synthesis. Scientific-technical collection.** Voprosy atomnoj nauki i tekhniki. no. 3. Velikhov, E.P. (ed.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. 62p. (In Russian). Order Number DE89012166/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Individual papers in this collection are indexed separately.

7001 Plasma Research

Refer also to citation(s) 36081, 36906, 36914, 36929, 36975, 37010, 37013, 37459, 37489, 37768, 37785

37713 (AD-A–204903/9/XAB) **Magnetohydrodynamic clump instability.** Tetreault, D.J. Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Nuclear Engineering. Aug 1988. 14p. Available from NTIS, PC A03/MF A01.

Pub. in Physics of Fluids, Vol. 31, No. 8, 2122-2134(Aug 1988).

The theory of magnetohydrodynamic (MHD) clump instability in current-driven plasma is presented. MHD clump fluctuations are current-carrying bundles of correlated magnetic field lines. The instability occurs when turbulent mixing of the mean current density at island overlap produces clumps at a rate faster than their decay as a result of magnetic-field-line stochasticity. The renormalized dynamical equation describing MHD clump instability is derived from one-fluid MHD equations and conserves the dynamical invariants of the exact equations. The renormalized equation is a nonlinear, turbulent version of the Newcomb equation of linear MHD stability theory and can be cast into the form of a nonlinear MHD energy principle. MHD clump instability is a dynamical route to the Taylor state.

37714 (CONF-890403–25) **Transport survey calculations using the spectral collocation method.** Painter, S.L.; Lyon, J.F. Oak Ridge National Lab., TN (USA). 1989. 10p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 7. international stellarator workshop; Oak Ridge, Tennessee, USA; 10-14

Apr 1989. Order Number DE89014090/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A novel transport survey code has been developed and is being used to study the sensitivity of stellarator reactor performance to various transport assumptions. Instead of following one of the usual approaches, the steady-state transport equation are solved in integral form using the spectral collocation method. This approach effectively combine the computational efficiency of global models with the general nature of 1-D solutions. A compact torsatron reactor test case was used to study the convergence properties and flexibility of the new method. The heat transport model combined Shaing's model for ripple-induced neoclassical transport, the Chang-Hinton model for axisymmetric neoclassical transport, and neoalcator scaling for anomalous electron heat flux. Alpha particle heating, radiation losses, classical electron-ion heat flow, and external heating were included. For the test problem, the method exhibited some remarkable convergence properties. As the number of basis functions was increased, the maximum, pointwise error in the integrated power balance decayed exponentially until the numerical noise level as reached. Better than 10% accuracy in the globally-averaged quantities was achieved with only 5 basis functions; better than 1% accuracy was achieved with 10 basis functions. The numerical method was also found to be very general. Extreme temperature gradients at the plasma edge which sometimes arise from the neoclassical models and are difficult to resolve with finite-difference methods were easily resolved. 8 refs., 6 figs.

37715 (CONF-890403–26) **Alpha-particle losses in compact torsatron reactors.** Painter, S.L.; Lyon, J.F. Oak Ridge National Lab., TN (USA). 1989. 11p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 7. international stellarator workshop; Oak Ridge, TN, USA; 10-14 Apr 1989. Order Number DE89014107/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Loss of alpha particles in compact torsatron reactors is studied. For 6, 9, and 12 field period reactors, the direct loss is a relatively weak function of radius and energy and varies from $\simeq$33% for M = 6 to $\simeq$18% for M = 12. Loss of alpha particles through scattering into the loss region is calculated using the Fokker-Plank equation for fast ions and found to contribute an additional alpha-particle energy loss of $\simeq$15%. The consequences of these relatively large losses for torsatron reactor design are discussed. The relationship between the direct particle losses and the magnetic field structure is also studied. Orbit losses from a variety of stellarator configurations are calculated and a figure-of-merit that characterizes the orbit confinement of a magnetic configuration is deduced from these calculations. This figure-of-merit is used to show how the direct losses might be reduced at low aspect-ratio. Effects of finite beta on the direct particle losses are also addressed, and are shown to significantly increase the direct losses in some configurations. 15 refs., 8 figs.

37716 (CONF-8906148–1) **Panel discussion: Progress and plans for magnetic fusion: Summary of comments on recent progress in fusion research at the Oak Ridge National Laboratory.** Sheffield, J. Oak Ridge National Lab., TN (USA). 1989. 7p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From Fusion Power Associates annual meeting; Washington, DC, USA; 1-2 Jun 1989. Order Number DE89013540/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Progress in fusion research is marked not so much by a few giant steps as by a continual number of small steps, which yield a steady advance toward the goal of producing a fusion reactor. During the past year, there have been two such steps in the Oak Ridge National Laboratory (ORNL) program: the experimental demonstration of access to the second stable region of beta in the Advanced Toroidal Facility (ATF); and the acceleration of a frozen hydrogen pellet by an intense electron beam. This paper discusses these steps.

37717 (EUR-CEA-FC–1342) **Determination of magnetic field direction in tokamaks from laser-induced Lyman-α fluorescence.** Voslamber, D. Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. Apr 1988. 127p. Available from NTIS (US Sales Only), PC A07/MF A01.

Resonant laser scattering in the Lyman-α line of hydrogen is investigated as a possible tool for measuring the magnetic field direction in tokamak plasmas. The method is based on the depolarisation-dependence of the scattering process. Limitations arising from depolarising collisions are studied in detail by employing a previously developed theory for the collisional redistribution of light. An error analysis is performed to derive the expected experimental precision under various plasma conditions and for laser energies ranging between 1 micron$J and 10 mJ. This analysis also includes the measurement of neutral hydrogen densities. It is shown that with presently available laser powers application of the method would be restricted to the border regions of the plasma. Application to the central regions would require further developments in laser technology, especially with regard to higher powers at the wavelength of Lyman-α and (or) to fast repetition rates.

37718 (EUR-CEA-FC–1354) **Turbulence and abnormal transport in tokamak plasmas.** Garbet, X. Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee; Aix-Marseille-2 Univ., 13 - Marseille (France). Centre Universitaire de Luminy. Sep 1988. 218p. (In French). Available from NTIS (US Sales Only), PC A10/MF A01.

Microinstabilities in linear and nonlinear tokamak plasmas were studied. A variational method based on the existence of a system of angular variables and action for the charged particles in the magnetic configuration of a tokamak is described. The corresponding functional, extremal in relation to the fluctuating electromagnetic field, is calculated analytically, taking into account the effects of the toroidal geometry. A numerical code, TORRID, was derived from these principles and the main instabilities, especially ion instabilities and microtearing, were studied linearly. Nonlinear methods were also applied to microtearing. Quasi-linear transport coefficients are derived from a principle of minimum entropy production. Thermal ionic conductivity and viscosity are calculated for an ionic turbulence.

37719 (EUR-CEA-FC–1356) **Plugging regime in the pump limiter throat.** Ghendrih, P.; Grosman, A.; Samain, A.; Capes, H.; Morera, J.P. Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. Aug 1988. 19p. Available from NTIS (US Sales Only), PC A03/MF A01.

The plugging regime -with no outstreaming neutral flux- is studied for a closed configuration pump limiter (throat). We derive the plugging length and the neutral density build-up at the neutralizer plate. The analytical expressions are supported by numerical evidence. We find an improved efficiency related to the throat effect mainly due to neutral-sidewall interactions.

37720 (GTFR–91) **Review of effects of NBI [neutral beam injection] and rotation on plasma transport in tokamaks.** Stacey, W.M. Jr. Georgia Inst. of Tech., Atlanta, GA (USA). Fusion Research Center. Jun 1989. 18p. Sponsored by DOE Energy Research. DOE Contract AS05-78ET52025. Order Number DE89014109/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The experimental and theoretical indications of effects of unbalanced neutral beam injection and plasma rotation on plasma transport in tokamaks are reviewed. 72 refs. (CBS)

37721 (INIS-SU–86/A, pp. 26-28) **Generator of a high-power microsecond REB.** Voropaev, S.G.; Konyukhov, V.V.; Lebedev, S.V.; Shcheglov, M.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Thermonuclear synthesis. Scientific-technical collection.* Order Number DE89012166/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

A generator of microsecond relativistic electron beam, developed for experiments on dense plasma heating in solenoids, is described. The generator comprises a capacitor (1.2 MW; 0.5 μF) and a cascade voltage multiplier. 12 refs.; 1 fig.

37722 (INIS-SU–86/A, pp. 40-45) **Plasma storage in the Yupiter-2M multislit electromagnetic trap.** Vdovin, S.A.; Lavrent'ev, O.A.; Maslov, V.A.; Nozdrachev, M.G.; Oboznyj, V.P.; Sappa, N.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Thermonuclear synthesis. Scientific-technical collection.* Order Number DE89012166/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

High-temperature plasma confinement in the Yupiter-2M multislit electromagnetic trap during electron injection is investigated. Results of determination of magnetic surface symmetry and adjustment of electrostatic system of magnetic slit locking are given. Profiles of density, electron temperatures, volumetric charge potential are recorded. The volume and area of plasma boundary surface are determined, plasma parameters are measured. In case of electron current of 0.1 A and injection time of 4 ms in the volume of 16l 7.10 ^{15} particles with the density of $4x10^{11}$ cm^{-3} and electron temperature of 13 eV are accumulated. Plasma potential increases with magnetic field increase reaching 300 V in case magnetic field in the circular shit of 10.5 kGs. The character of electron diffusion transfer across magnetic field is studied and the absence of anomalously high loss flows from the trap is shown. Efficiency of plasma confinement in axial holes of the trap is considered and it is found that losses through axial holes do not exceed 6% of total loss of ions from the trap. The absense of high-frequency activity in plasma and high efficiency of electron injection are pointed out. 8 refs.; 6 figs.

37723 (INIS-SU–86/A, pp. 53-55) **Fast current rise studied in the steady-state discharge of the Tuman-3 device.** Askinazi, L.G.; Bogdanova, N.E.; Golant, V.E.; Gryaznevich, M.P.; Izvozchikov, A.B.; Lebedev, S.V.; Sakharov, N.V.; Shakhovets, K.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Thermonuclear synthesis. Scientific-technical collection.* Order Number DE89012166/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

Mathematical simulation of experiments with rapid current rise i_p=25 MA/s in the Tuman-3 tokamak is performed. It is shown that the time of current density stationary profile installation, which in the experiment is an order lower the skin time calculated for the whole cord is determined by the time of current pass through external region of plasma cord, where q>1. In the process of current rise on plasma periphery a developed magnetic island for the second mode is formed, as a result, thermal conductivity in the external part of the cord increases and periphery is not warmed up, therefore, the time of current penetration inside the cord decreases. Experimental data do not contradict neoclassical conductivity theory. 12 refs.; 5 figs.

37724 (INIS-SU–86/A, pp. 49-52) **Impurity ion diffusion in stellaration-type traps.** Zolotukhin, A.V.; Shishkin, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Thermonuclear synthesis. Scientific-technical collection.* Order Number DE89012166/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

Geometric factor of impurity ion diffusion coefficient (known for tokamak as the Rutherford formula) for the case of stellarator traps with sattellite harmonic composition of magnetic field and magnetic surface function is generalized. The geometric factor is analyzed for the Uragan-2M, ATF-1, Heliotron-E torsatrons, as well as for the Wendelstein AS module trap. Important role of satellite harmonics in the decrease of impurity ion diffusion coefficients is shown. 9 refs.

37725 (INIS-SU–86/A, pp. 13-23) **AMBAL-YU experiment.** Dimov, G.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Thermonuclear synthesis. Scientific-technical collection.* Order Number DE89012166/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

The AMBAL-YU facility, which is an adiabatic quadrupole trap, is briefly described. The program of experiment in the facility comprises: production of high-temperature quasistationary plasma; improvement of anisotropic microinstability suppression; study on ion-cyclotron resonance heating of target and stabilizing plasma; investigation of halo and interaction of hot plasma with walls; optimization of vacuum conditions; consideration of ambipolar electric field in plasma, in the range of plugs and beyond the plug regions in particular. Substantiation of the experiment program is given. Vacuum conditions in the trap are described in detail. 48 refs.; 5 figs.

37726 (INIS-SU–86/A, pp. 34-39) **On the ion temperature measurement by the CO_2-laser radiation scattering in tokamaks.** Aslanov, G.A.; Burbaev, T.M.; Zhukovskij, V.G.; Kurbatov, V.A.; Penin, N.A.; Rtishchev, V.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Thermonuclear synthesis. Scientific-technical collection.* Order Number DE89012166/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

Plasma diagnosis for the measurement of ion temperature in time in plasma of the T-15 facility for CO_2-laser radiation scattering on plasma density thermal fluctuations is considered. The use of pulse-periodic CO_2-laser of the Dyatel type with a high energy per pulse permits to record ion temperature at plasma density of >or approx. 1.10^{13} cm^{-3}. The detection system is considered. On the basis of experimental data it is shown that parameters of the studied Ge:Zn detectors are sufficient for measurement conduction. The given method is compared with other scattering diagnostics developed abroad. 25 refs.; 4 figs.

37727 (INIS-SU–94/A, pp. 47-49) **Effect of electron distribution function inhomogeneity on heat transfer in a laser-produced plasma.** Gamalij, E.G.; Kiselev, A.E. AN SSSR, Moscow (USSR). Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics.* Order Number DE89012156/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Kratkie soobshcheniya po fizike.; no. 8.

The effect of electron distribution function inhomogeneity, occurring in bremsstrahlung absorption of laser light, on heat transfer is determined by the numerical solution of the kinetic equation. In comparison with the classical value, the heat flux is found to be decreased more than 1.5 times at > 10^{14} W/cm^2 laser radiation rate. 5 refs.; 2 figs.

37728 (IPPJ–815) **Homeostasis in plasma confinement at beta close to unity.** Hirano, Kei-ichi. Nagoya Univ. (Japan). Inst. of Plasma Physics. Feb 1987. 12p. Order Number DE88780058/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

A steady state solution to magnetic confinement system has been studied self-consistently to find how energy confinement time tau_E is adjusted to meet required exact balancing of injected and flowing out fluxes of particles and energies. It is demonstrated that, in case high power input into a plasma is allowed to ensure $< \beta > 1$ state, homeostasis appears and tau_E becomes independent of any transport process.

37729 (IPPJ–822) **Long-time correlation for the chaotic orbit in the two-wave Hamiltonian.** Hatori, Tadatsugu; Irie, Haruyuki. Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1987. 35p. Order Number DE88780060/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The time correlation function of velocity is found to decay with the power law for the orbit governed by a Hamiltonian, $H = v^2/2\text{-}M \cos x - P \cos[k(x - t)]$. The renormalization group technique can predict the power of decay for the correlation function defined by the ensemble average. The power spectrum becomes the 1/f-type for a special case.

37730 (IPPJ–823) **Plasma current startup by lower hybrid waves in the JIPP T-IIU tokamak.** Toi, K.; Ohkubo, K.; Kawahata,

K. Oak Ridge Technical Enterprises, TN (USA). Apr 1987. 36p. Order Number DE88780061/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

This paper describes the characteristic behaviours of lower hybrid current startup in JIPP T-IIU. The current startup is carried out by injection of 800 MHz lower hybrid waves into cold and low density plasmas (Te = 10 to 20 eV, n-bar$_e$ = 1 to 2 x 10^{12} cm^{-3}) produced by electron cyclotron resonance or lower hybrid waves only. The plasma current rises up with a characteristic rise time tau$_r$($\geq \sim$ 30 to 50 ms) and approaches a quasi-steady state value I_{pm} (=5 to 20 kA), when LHW power of 10 to 50 kW is injected into a torus, controlling the vertical field. The rise time is inversely proportional to the bulk electron density n-bar$_e$, and is comparable to the collision time of current-carrying high energy electrons with bulk plasmas. On the other hand, the current drive efficiency in the quasi-steady state is almost independent of n-bar$_e$, i.e., $I_{pm}P_{LH}$ = 0.4 to 0.7 A/W for n-bar$_e$ = 0.8 to 4 x 10^{12} cm^{-3}. The conversion efficiency of rf energy injected into the torus is typically 5% during current rise phase, and 10% at the most efficient case. The effects of the initial injection of ECH power and the observed parametric instabilities on the current startup are investigated from a viewpoint of seed current generation. During rapid current rise when appreciably negative loop voltage is observed the bulk electrons are heated up to 150 eV. Various heating mechanisms responsible for the bulk electron heating are discussed.

37731 (IPPJ–824) **Energy eigenvalues of helium-like atoms in dense plasmas.** Hashino, Tasuke; Nakazaki, Shinobu; Kato, Takako; Kashiwabara, Hiromichi. Nagoya Univ. (Japan). Inst. of Plasma Physics. Apr 1987. 15p. Order Number DE88780062/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Calculations based on a variational method with wave functions including the correlation of electrons are carried out to obtain energy eigenvalues of Schroedinger's equation for helium-like atoms embedded in dense plasmas, taking the Debye-Hueckel approximation. Energy eigenvalues for the 1^1S, 2^1S, and 2^3S states are obtained as a function of Debye screening length.

37732 (IPPJ–826) **Measurement of radiation power from the JIPP T-IIU tokamak plasma.** Ogawa, Isamu. Nagoya Univ. (Japan). Inst. of Plasma Physics. Apr 1987. 101p. Order Number DE88780063/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

Characteristics of a pyroelectric detector, a metal-film bolometer and a thermistor are investigated in order to attain high reliability of the bolometric measurement. The spurious signal which appears on a pyroelectric detector is efficiency eliminated by setting a mask close to the detector, which has a function of avoiding the direct incidence of photons on its electrode. This is verified with the consistency of integrated value of the signal. The detector is calibrated with a HeNe laser taking the reflection on the detector surface into account. No temporal change has been seen on the sensitivity of the detector calibrated by this method. We also developed a thin metal-film bolometer with high sensitivity (12.9 Ω/mJ), high time response (3 μs) and well defined thermal characteristics. The calibration of this detector was performed by supplying a bias current through its resistor. We constructed a bolometric system with high time response and high spatial resolution, which consisted of twelve pyroelectric detectors and a metal-film bolometer. The radiation power measured with the pyroelectric detector agrees with that measured with the calibrated metal-film bolometer within 10%. Spectroscopic and bolometric measurements with spatial and temporal resolution show that large radiation loss brings about the decrease in electron and ion temperatures and plasma energy. Carbon limiters have an effect to suppress the radiation power for ohmic plasma, but are insufficient for ICRF heated plasma. The main contribution to radiation power may be attributed to Fe impurity released from the ICRF antennae, the Faraday shield and vacuum vessel. By making carbonization of the wall and in-vessel components, the Fe impurity is suppressed to a low level (n_{Fe}/n_e 0.04%) and the radiation power is reduced to $P_{rad}/(P_{OH} + P_{rf})$ 20% and emissivity throughout the plasma region is reduced.

37733 (JAERI-M–88-229) **Measurement of the current distribution in JT-60 plasma by He beam.** Nishino, Nobuhiro; Kubo, Hirotaka; Koide, Yoshihiko; Sakasai, Akira; Sugie, Tatsuo; Takeuchi, Hiroshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Nov 1988. 29p. (In Japanese). Order Number DE89790752/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The current distribution in a tokamak plasma concerns with plasma confinement and MHD stabilization, moreover, this gives the helpful information of the current drive technique by non-inductive method, for example LHCD, necessary in a tokamak fusion reactor. However, it is impossible to measure the current distribution directly, we have to measure the poloidal magnetic field instead of this distribution. We propose the poloidal field measurement in JT-60 by Zeeman effect of line spectra from neutral He beam. When viewing perpendicular to the magnetic field direction, the π components of the splitting lines are polarized parallel to the field. The local field direction is determined from the polarization angle of the spectral line. A spatially resolved measurement can be realized by several detection systems. When using the active beam apparatus (200 keV, 0.6A, 100 ms) as probe beam of this system, the photon number and SN ratio are small in case of the electron density being larger than 6 x 10^{19} m^{-3} because of beam attenuation. The electron density is smaller than 6 x 10^{19} m^{-3} in LHCD experiments, therefore it is able to measure the current distribution in JT-60. However, the new method will be needed in high density plasma.

37734 (LA-UR–89-2085) **Design of an explosive pulsed power system for driving 16-MA plasma flow switch experiments.** Goforth, J.H.; Caird, R.S.; Fowler, C.M.; Greene, A.E.; Hodgdon, M.L.; Lindemuth, I.R.; Marsh, S.P.; Oona, H.; Reinovsky, R.E.; Turchi, P.J. Los Alamos National Lab., NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890710–9: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014297/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have described a system that uses a MK-IX helical generator to deliver 11 MA to a 140-nH pulse compression circuit. The purpose of that system is to drive a plasma z-pinch experiment. 11 refs., 5 figs.

37735 (LA-UR–89-2088) **The high density z-pinch II experiment.** Hammel, J. Los Alamos National Lab., NM (USA). 1989. 6p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8904107–6: 2. international conference on high-density pinches (ICHDP-2), Laguna Beach, California, USA, 26-28 Apr 1989). Order Number DE89014295/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The HDZP II is an experiment with the objective of taking a z-pinch plasma, created from a small diameter solid deuterium fiber, up to the Pease-Braginskii current limit while maintaining Bennett equilibrium (constant radius) throughout the current pulse. This paper discusses this experiment.

37736 (LA-UR–89-2144) **Radiative collapse of a Bennett-relaxed z-pinch.** Turner, L. Los Alamos National Lab., NM (USA). 1989. 10p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8904107–5: 2. international conference on high-density pinches (ICHDP-2), Laguna Beach, California, USA, 26-28 Apr 1989). Order Number DE89014290/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

The global evolution of a z-pinch has been studied with the assumption of a relaxed state consisting of ions and electrons, each in a rigidly drifting isothermal Maxwellian distribution. This speculative approach has the pragmatic feature of possessing phenomenologically useful global parameters such as drift velocity and temperature that vary in accordance with global physical quantities such as energy and entropy. The plasma gains energy from a time-dependent electric field by means of Poynting's vector. Coulomb collisions between electrons and ions is calculated with a Fokker-Planck treatment analogous to that used by Dreicer to calculate runaways. For a variety of initial conditions and time-independent applied electric fields, the pinch evolution always culminates in a time-independent (attractor) state whose current is the Pease-Braginskii current and whose final radius is proportional to (line density)$^{3/4}$/(electric field)$^{1/2}$. Before the final state is attained, the pinch may bounce toward and away from a highly collapsed state. For the case of a

Bennett pinch, the classical limit of the resistivity is attained when the line density is much greater than $4\pi m_e/e^2\mu_o$; i.e., 3.55×10^{14} m^{-1}. 6 refs., 2 figs.

37737 (LA-UR–89-2188) **The stability of the High-Density Z-Pinch.** Glasser, A.H.; Nebel, R.A. Los Alamos National Lab., NM (USA). 1989. 16p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8904107–7: 2. international conference on high-density pinches (ICHDP-2), Laguna Beach, CA, USA, 26-28 Apr 1989). Order Number DE89014276/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

Fiber-initiated High Density Z-Pinches at Los Alamos, NRL, and Karlsruhe have shown anomalously good stability. Kink modes are never seen, and sausage modes are at least delayed until late in the discharge. The success of these devices in reaching fusion conditions may depend on maintaining and understanding this anomalous stability. We have developed two numerical methods to study the stability in the regime where fluid theory is valid. While our methods are applicable to all modes, we will describe them only for the m = 0 sausage mode. The appearance of sausage modes late in the discharge and the total absence of kink modes suggest that an understanding of sausage modes is more urgent, and it is also simpler. 14 refs., 8 figs.

37738 (PPPL–2623) **Atomic physics studies of highly charged ions on tokamaks using x-ray spectroscopy.** Beiersdorfer, P.; von Goeler, S.; Bitter, M.; Hill, K.W. Princeton Univ., NJ (USA). Plasma Physics Lab. Jul 1989. 42p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE89014600/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An overview is given of atomic physics issues which have been studied on tokamaks with the help resolution x-ray spectroscopy. The issues include the testing of model calculations predicting the excitation of line radiation, the determination of rate coefficients, and accurate atomic structure measurements. Recent research has focussed primarily on highly charged heliumlike ($22 \leq Z \leq 28$) and neonlike ($34 \leq Z \leq 63$) ions, and results are presented from measurements on the PLT and TFTR tokamaks. Many of the measurements have been aided by improved instrumental design and new measuring techniques. Remarkable agreement has been found between measurements and theory in most cases. However, in this review those areas are stressed where agreement is worst and where further investigations are needed. 19 refs., 13 figs., 2 tabs.

37739 (PPPL–2630) **Pulse length assessment of compact ignition tokamak designs.** Stotler, D.P.; Pomphrey, N. Princeton Univ., NJ (USA). Plasma Physics Lab. Jul 1989. 31p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE89014601/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A time-dependent zero-dimensional code has been developed to assess the pulse length and auxiliary heating requirements of Compact Ignition Tokamak (CIT) designs. By taking a global approach to the calculation, parametric studies can be easily performed. The accuracy of the procedure is tested by comparing with the Tokamak Simulation Code which uses theory-based thermal diffusivities. A series of runs is carried out at various levels of energy confinement for each of three possible CIT configurations. It is found that for cases of interest, ignition or an energy multiplication factor $Q \gtrsim 7$ can be attained within the first half of the planned five-second flattop with 10–40 MW of auxiliary heating. These results are supported by analytic calculations. 18 refs., 7 figs., 2 tabs.

37740 (PPPL–2631) **Multiple mode model of tokamak transport.** Singer, C.E.; Ghanem, E.S.; Bateman, G.; Stotler, D.P. Princeton Univ., NJ (USA). Plasma Physics Lab. Jul 1989. 12p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE89014598/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Theoretical models for radical transport of energy and particles in tokamaks due to drift waves, rippling modes, and resistive ballooning modes have been combined in a predictive transport code. The resulting unified model has been used to simulate low confinement mode (L-mode) energy confinement scalings. Dependence of global energy confinement on electron density for the resulting model is also described. 26 refs., 1 fig., 2 tabs.

37741 (PPPL–2634) **Tokamak electrical conductivity modified by electrostatic trapping in the applied electric field.** Chang, C.S. Princeton Univ., NJ (USA). Plasma Physics Lab. Jul 1989. 17p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE89014606/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Passing electrons traveling in the same direction as the applied Ohmic electric field, near the trapped-passing boundary, can get electrostatically trapped by the applied Ohmic potential, reverse their parallel flow direction, and become passing particles traveling in the opposite direction. The number of these electrons is proportional to the applied voltage and is small. But, the amount of change in their time-averaged parallel velocity by reversing their flow direction, is about twice the average parallel velocity of the barely passing electrons and is large. Hence, these electrostatically trapped particles can significantly contribute to the Ohmic electrical current. The new electrical conductivity is calculated in the banana regime using a pitch angle scattering operator, and the values are found to be significantly enhanced from previous neoclassical theories. 4 refs., 2 figs.

37742 (SAND–88-3311C) **Two-dimensional effects in imploding plasma liners.** Roderick, N.F.; Hussey, T.W. Sandia National Labs., Albuquerque, NM (USA). [1989]. 12p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890710–1: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014482/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Analytic modeling and magnetohydrodynamic simulations have been conducted to investigate two-dimensional effects in imploding plasma shells. These effects include short wavelength disturbances caused by instabilities at the plasma magnetic field interface, long wavelength instabilities associated with plasma annulus formation, and perturbations resulting from the power flow to the plasma annulus. The numerical calculations were carried out using the two-dimensional single-fluid MHD code MACH2 for different plasma density profiles and electrode geometries. Results for short wavelength perturbations show that these phenomena behave in a manner consistent with analytic linear and heuristic nonlinear models. At stagnation they have a negligible effect on the uniformity during the initial coupling to the target, even for large initial perturbations. The disturbances manifest themselves primarily in a rippling of the back of the plasma shell with significant effects, even in this region, not occurring until late in the stagnation process. Long wavelength perturbations produced by a straight axial gas injection for gas puff implosions can lead to pronounced axial nonuniformity, "zippering," at stagnation. Variations of the injection conditions and electrode geometry can produce more uniform stagnation. Changes in the mass profile, gas injection angle, and electrode shape can all be used to achieve significantly greater stagnation uniformity. Consistent calculations for a entire implosion process form gas injection to stagnation including vacuum power flow indicate the degree of coupling of short wavelength, long wavelength and power flow perturbations. Comparison with experimental data show agreement between analytic, numerical and experimental results. 23 refs., 6 figs.

37743 (SAND–89-0443C) **Two-dimensional effects in hollow core Z-pinches.** Roderick, N.F.; Hussey, T.W. Sandia National Labs., Albuquerque, NM (USA). 1989. 15p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8904107–4: 2. international conference on high-density pinches (ICHDP-2), Laguna Beach, California, USA, 26-28 Apr 1989). Order Number DE89014188/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Analytic modeling and magnetohydrodynamic simulations have been conducted to investigate two-dimensional effects in imploding plasma shells. These effects include short wavelength disturbances caused by instabilities at the plasma magnetic field interface, long wavelength instabilities associated with plasma annulus formation, and perturbations resulting from the power flow to the plasma

annulus. The numerical calculations were carried out using the two-dimensional single-fluid MHD code MACH2 for different plasma density profiles and electrode geometries. Results for short wavelength perturbations show that these phenomena behave in a manner consistent with analytic linear and heuristic nonlinear models. At stagnation they have a negligible effect on the uniformity during the initial coupling to the target, even for large initial perturbations. The disturbances manifest themselves primarily in a rippling of the back of the plasma shell with significant effects, even in this region, not occurring until late in the stagnation process. Long wavelength perturbations produced by a straight axial gas injection for gas puff implosions can lead to pronounced axial nonuniformity, "zippering," at stagnation. Variations of the injection conditions and electrode geometry can produce more uniform stagnation. Changes in the mass profile, gas injection angle, and electrode shape can all be used to achieve significantly greater stagnation uniformity. Consistent calculations for a entire implosion process from a gas injection to stagnation including vacuum power flow indicate the degree of coupling of short wavelength, long wavelength and power flow perturbations. Comparison with experimental data show agreement between analytic, numerical and experimental results. 23 refs., 7 figs.

37744 (UCLA/PPG–1237) **Role of alpha particle damping in fast wave current drive and heating.** Mau, T.K. California Univ., Los Angeles, CA (USA). Inst. for Plasma and Fusion Research. May 1989. 9p. Sponsored by DOE Energy Research. DOE Contract FG03-88ER52151. (CONF-8905120–18: 8. topical conference on radio frequency power in plasmas, Irvine, CA, USA, 1-3 May 1989). Order Number DE89014609/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The impact of energetic alpha particle wave absorption on the range of frequencies for efficient fast wave current drive and heating in a fusion reactor is investigated. The energetic alpha damping decrement is calculated, using a slowing down distribution function, and compared to electron and fuel ion damping over a wide range of frequencies. A combination of strong alpha damping and edge electron absorption in the higher ion harmonic regime limits core fast wave current drive to the lower harmonics (1 = 2,3). 4 refs., 4 figs.

37745 High intensity laser-matter interactions. SPIE - Volume 913. Campbell, E.M.; Baldis, H. 181p. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-8801117–: High intensity laser matter interactions, Los Angeles, CA, USA, 12-13 Jan 1988).

These proceedings collect papers on intense laser-matter interactions. Topics include: laser-plasma interactions, laser-fusion compression, laser-driven plasma accelerators, physics of condensed matter, x-ray holography, XUV lasers, x-ray emission from laser plasmas, terawatt lasers, and behavior of metals under laser illumination.

37746 Spatial structure of transient plasmas revealed with a CCD camera. Scheeline, A. (School of Chemical Sciences, Univ. of Illinois, Urbana, IL (US)); White, J.S.; Mork, B.J. v.v of 1988 Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy (abstracts). Pittsburgh Conference, Pittsburgh, PA (1988). (CONF-880204–: 39. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, New Orleans, LA, USA, 22-26 Feb 1988).

Technical Paper NO. 041.

Spark discharges, used for quantitative analysis of conducting solids, have been examined with spatial and temporal resolution for many years. Numerous doubts concerning the fidelity of the data have arisen, due to the nonlinearity of detector response. The recent availability of charge-coupled array detectors (CCDs) has permitted the solution of this problem. Linear response over four orders of magnitude, negligible blooming, and total freedom from distortion can be obtained with commercially available apparatus. Time-gated spatially-resolved data from a high voltage unidirectional spark in argon are shown, indicating for the first time the amount of self-absorption in the spark and the symmetry of the vapor cloud produced by the spark. Correlations with previous models of vapor propagation are made.

37747 Electron beam propagation in inhomogeneous media. Lee, M.H. (Univ. of Georgia, Dept. of Physics and Astronomy, Athens, GA (US)). v.v of Nonlinear optical beam manipulation, beam combining, and atmospheric propagation. Fischer, R.A. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-8801121–: Nonlinear optical beam manipulation, beam combining, and atmospheric propagation, Los Angeles, California, USA, 11-14 Jan 1988).

This study concerns energetic dense electron beam propagation in nuclear disturbed environments. In particular, it centers on beam losses through dissipation processes. Relevant atmospheric conditions known from high-altitude nuclear explosions are summarized. Modeling of geomagnetic data as well as some new theoretical ideas for studying beam propagation are briefly described.

37748 Ionization equilibrium in dense plasmas. Ying, R. Thesis (Ph. D.). 384p. Boston College, Boston, MA (1987). Available from University Microfilms, PO Box 1764, Ann Arbor, MI 48106, Order No.88-07,578.

The average degree of ionization for a strongly coupled plasma is investigated and calculated. Two widely used approaches: the Saha equation method and the Thomas-Fermi (TF) statistical atomic model are adopted to determine the degree of ionization. Both methods are modified in a number of ways to include the strong-coupling effect in the plasma. In the Saha equation approach, the strong-coupling effects are introduced through: (i) a replacement of the Coulomb potential by a screened Debye potential; (ii) adoption of the Planck-Larkin partition function; (iii) description of the electron component by Fermi-Dirac statistics. The calculated degree of ionization exceeds that obtained from the original Saha equation, exhibits a minimum as a function of the density and shows an abrupt phase transition from weakly ionized to a fully ionized state. The zero-temperature TF model for compressed ions and the finite-temperature TF model for ions are investigated for the first time. In order to take into account the strong-coupling effect in a systematic way, a strong-coupling TF model is set up. Favorable results with the relatively simple approximations indicate that the newly established strong-coupling TF model is a more systematic and physically consistent approach.

37749 A computer model of the ZTH energy system at Los Alamos. Honkel, H. (Los Alamos National Lab., Los Alamos, NM (US)). *IEEE Computer Applications in Power (USA),* 2(2): 23-26 (Apr 1989).

Controlled thermonuclear fusion research began in the 1950s in the United States, Breat Britain, and the Soviet Union. From the beginning, Los Alamos was a leader in this research and continues to play an important role. From the world's first successful laboratory experiments to produce magnetically confined thermonuclear reactions (at Los Alamos in 1958), significant advances have been made throughout the world in magnetic confinement research. As part of the magnetic fusion energy research program to develop fusion energy as a practical, economical energy resource, Los Alamos is investigating two concepts of fusion: the reversed field pinch (RFP) and the compact toroid. These concepts have much potential as small, compact fusion energy sources. Using the results of an experimental small fusion energy machine (ZT-40M) at Los Alamos as a basis, a larger, higher energy machine is being constructed, called ZTH. The ZTH machine originally had a design plasma current magnitude of 4 million amperes (4MA) compared to the smaller ZT-40M machine of 450,00 amperes. The system is presently under construction in a 2MA-rated configuration.

37750 An overview of atomic and molecular processes in critical velocity ionization. Lai, S.T. (Air Force Geophysics Lab., Hanscom Air Force Base, Bedford, MA (US)); Murad, E.; McNeil, W.J. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA),* 17(2): 124-134 (Apr 1989).

Alfven's critical ionization velocity (CIV) is a multistep process involving plasma physics and plasma chemistry. The authors present an overview of the time development of some atomic and molecular processes in CIV. In the pre-onset stage, metastable states play an important role: They provide an energy pooling mechanism allowing low energy electrons to participate in the ionization processes; they may explain the low energy threshold as well as the fast time scale

in the onset of CIV. For a sustaining CIV to occur, Townsend's criterion has to be satisfied. The kinetic energies of the neutrals are transformed to plasma wave energies via beam-plasma instabilities, and the plasma waves that heat the electrons result in a tail formation. Excitation of neutrals with subsequent radiation is an important energy loss mechanism. Finite beam size also limits the instability growth rate. In the propagation of CIV, ion-molecule reactions and molecular dissociative recombination are important. Ion-molecule reactions change the temporal chemical composition in a CIV process and help explain some results in CIV experiments. Molecular dissociative recombination reduces the plasma density, lowers the effective neutral mass, and loses energy via excitation and radiation; it tends to quench the propagation of CIV. Depending on various parameters, oscillatory behavior of CIV may occur.

37751 A heat-driven monochromatic light source. Stefani, F. (Carnegie Mellon Univ., Pittsburgh, PA (US)); Lawless, J.L. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA),* 17(2): 295-302 (Apr 1989).

This work investigates theoretically the efficiency with which heat may be converted into resonance radiation in a cesium thermionic diode. An analytical model of a thermionic converter is employed which combines the coupled effects of line radiation transport, excited-state kinetics, and plasma diffusion. Operating regimes are established for various degrees of optical density in the plasma. The results indicate that monochromatic radiation can be produced with efficiencies on the order of 30 percent provided there is an adequate voltage drop across the plasma. In this study, a drop of one volt was used since it can be maintained without any electrical power input to the device. It is found that high efficiencies come by virtue of the higher interelectrode distances which the solutions will accommodate, and that radiation can be generated efficiently, even with optically dense gases.

37752 X-ray absorption spectroscopy of laser-produced plasmas: A study of the experiment and data analysis. Balmer, J. (Institute for Applied Physics, University of Berne, Berne, Switzerland(CH)); Lewis, C. L. S.; Corbett, R. E.; Robertson, E.; Saadat, S.; O'Neill, D.; Kilkenny, J. D.; Back, C. A.; Lee, R. W. *Physical Review [Section] A: General Physics (USA),* 40(1): 330-340 (1 Jul 1989).

The novel technique of point-projection backlighting is used to probe alaser-produced plasma. A spatially restricted source of x rays is created byirradiating a fiber which is used to backlight a plasma. Temporal resolution ofthe absorption spectrum is obtained by creating the backlight with a pulse thatis delayed in time from the main, plasma-producing, laser. The backlight canalso be of shorter duration than the main laser pulse providing for enhancedtime resolution and therefore less temporal averaging. The results forlow-Z aluminum and silicon targets are presented. The low-Zabsorption spectra using both low-Z (e.g., aluminum) and high-Z(e.g., molybdenum) elements for backlighting are studied. A description of thistechnique and the analysis of the data obtained is presented.

37753 Dynamics of a collisional, capacitive RF sheath. Lieberman, M.A. (Univ. of California, Berkeley, Berkeley, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA),* 17(2): 338-341 (Apr 1989).

A self-consistent solution for the dynamics of a high-voltage, capacitive RF sheath driven by a sinusoidal current source is obtained, under the assumptions of time-independent, collisional ion motion and inertialess electrons. The results are that the ion current density is $1.68\epsilon_o(2e/M)^{1/2}V\text{-bar}^3 2/\lambda_i^{1/2}/s^5 2/_m$, where V-bar is the dc self-bias voltage, λ_i is the ion mean free path, s_m is the sheath thickness, e/M is the ion charge-to-mass ratio, and ϵ_o is the free-space permittivity, the sheath capacitance per unit area for the fundamental voltage harmonic is $1.52\epsilon_o/s_m$, the ratio of the dc to the peak value of the oscillating voltage is 0.40, the second and third voltage harmonics are, respectively, 19.3 and 5.3 percent of the fundamental, and the conductance per unit area for stochastic heating by the oscillating sheath is $2.17(e^2n_o/m\mu_e)\lambda^2 3/_D/\lambda_i s_m^{1/3}$, where n_o is the ion density and λ_D is the Debye length at the plasma-sheath edge, and $\mu_e = (8eT_e/\pi m)^{1/2}$ is the mean electron speed.

7002 Fusion Power Plant Technology

Refer also to citation(s) 36907, 36909, 36915, 36916, 36929, 36930, 36951, 37004, 37005, 37007, 37016, 37480, 37745

37754 (CEA-CONF–9767) **Prospects of ceramic tritium breeder materials.** Roth, E.; Conservatoire National des Arts et Metiers; , 75 - Paris; Charpin, J.; Roux, N. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie. 1988. 33p. (CONF-880929–: 15. symposium on fusion technology, Utrecht, Netherlands, 19-23 Sep 1988). Order Number DE89789262/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

An overall evaluation of value as blanket material in attempted. The ceramic exhibiting the lowest residence time for tritium is Li_2ZrO_3 which enables one to envisage operating with this material a ceramic blanket at temperatures even lower than with Li_2O. Tentative conclusions from considerations on blanket concepts and experimental results that we quote in this paper favor giving more importance to studies of ceramic breeder blankets for NET or ITER than seems the case presently. 35 refs.

37755 (CFFTP-G–85041) **Review of synergisms in materials erosion due to multispecies impact.** Haasz, A.A.; Auciello, O.; Stangeby, P.C. Canadian Fusion Fuels Technology Project, Toronto, ON (Canada). May 1985. 62p. (UTIAS–47). Order Number DE89618772/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Plasma-surface interaction phenomena have become a subject of major interest because of their relevance in two important technological developments of recent decades, viz, microelectronics and thermonuclear fusion. Microelectronic fabrication often involves the use of relatively low-pressure/low-temperature plasma discharges for etching micron-size features in integrated circuits; here erosion is a desired effect. Fusion plasmas, by contrast, cause erosion of the fusion device inner walls, which is generally not desirable. In both cases surfaces are bombarded simultaneously by plasma species which include ions, neutral atoms, electrons and photons, which might lead to enhanced erosion due to synergistic effects. Work performed to date suggests that similar chemistry may be involved in the erosion process associated with some semiconductor and fusion related materials: SiF_4, $SiCl_4$ and CH_4, are, for example, some of the principal species evolving from Si and C surfaces, when exposed to F, Cl and H atoms, respectively, causing the observed erosion. Considerable effort has been expended on studies involving synergistic effects for semiconductor fabrication. Research on synergism related to the erosion of fusion materials (C and carbon compounds) commenced comparatively recently; however, its importance has been increasingly recognized, and evidence of possible synergistic erosion of graphite has recently been obtained in the PLT fusion device. In light of the the interdisciplinary nature of the subject, experimental and theoretical work on synergistic effects in erosion of both semiconductors and fusion materials will be critically reviewed here in an attempt to unify concepts related to results and mechanisms proposed to explain the observed phenomena, and to explore possible new avenues of research. 128 refs.

37756 (CFFTP-G–86045) **Neutronics analysis for aqueous self-cooled fusion reactor blankets.** Varsamis, G.; Embrechts, M.J.; Jaffa, R.; Steiner, D.; Deutsch, L.; Gierszewski, P. Canadian Fusion Fuels Technology Project, Toronto, ON (Canada). Jun 1986. 7p. (CONF-860652–: 7. topical meeting on the technology of fusion energy, Reno, Nevada, USA, 15-19 Jun 1986). Order Number DE89618746/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The tritium breeding performance of several Aqueous Self-Cooled Blanket (ASCB) configurations for fusion reactors has been evaluated. The ASCB concept employs small amounts of lithium compound dissolved in light or heavy water to serve as both coolant and breeding medium. The inherent simplicity of this concept allows the development of blankets with minimal technological risk. The tritium breeding performance of the ASCB concept is a critical issue for this family of blankets. Contrary to conventional blanket designs there will be a significant contribution to the tritium breeding ratio (TBR) in the water coolant/breeder of duct shields, and the 3-D TBR will therefore be similar to the 1-D TBR. The tritium breeding

performance of an ASCB for a MARS-like-tandem reactor and an ASCB based breeding-shield for the Next European Torus (NET) are assessed. Two design options for the MARS-like blanket are discussed. One design employs a vanadium first wall, and zircaloy for the structural material. The trade-offs between light water and heavy water cooling options for this zircaloy blanket are discussed. The second design option for MARS relies on the use of a vanadium alloy as the stuctural material, and heavy water as the coolant. It is demonstrated that both design options lead to low-activation blankets that allow class C burial. The breeder-shield for NET consists of a water-cooled stainless steel shield.

37757 (CFFTP-G–87005) **Canadian contributions to the safety and environmental aspects of fusion.** Stasko, R.; Wong, K. Canadian Fusion Fuels Technology Project, Toronto, ON (Canada). May 1987. 10p. (CONF-8705358–: Canadian Nuclear Society annual meeting, Montreal, Canada, 18-22 May 1987). Order Number DE89619915/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Since next-step fusion devices will be fuelled with mixtures of tritium and deuterium, the knowledge base and tritium handling experience associated with the operation of CANDU reactors is viewed as relevant to the development of safe fusion technology. Fusion safety issues will be compared with fission safety experience, after which specific Canadian activities in support of fusion safety will be overviewed. In addition, recommendations for appropriate fusion safety criteria will be summarized. 18 refs.

37758 (CONF-8904230–1) **Recent results on cleaning and conditioning the ATF vacuum system.** Langley, R.A.; Clark, T.L.; Glowienka, J.C.; Goulding, R.H.; Mioduszewski, P.K.; Rasmussen, D.A.; Rayburn, T.F.; Schaich, C.R.; Shepard, T.D.; Simpkins, J.E.; Yarber, J.L. Oak Ridge National Lab., TN (USA). 1989. 11p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From AVS topical conference on surface conditioning of vacuum systems; Los Angeles, California, USA; 3-7 Apr 1989. Order Number DE89012971/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Techniques for cleaning and conditioning the vacuum vessel of the Advanced Toroidal Facility (ATF) and its internal components are described. The vacuum vessel cleaning technique combines baking to 150°C and glow discharges with hydrogen gas. Chromium gettering is used to further condition the system. The major internal components are the anodized aluminum baffles in the Thomson scattering system, a graphite-shielded ICRF antenna, two graphite limiters, and a diagnostic graphite plate. Three independent heating systems are used to bake some of the major components of the system. The major characteristics used for assessing cleanliness and conditioning progress are the maximum pressure attained during bakeout, the results of gas analysis, and relevant plasma parameters (e.g., time to radiative decay). Details of the various cleaning and conditioning procedures and results are presented. 5 refs., 8 figs., 3 tabs.

37759 (DOE/ER–0313/5) **Fusion reactor materials semiannual progress report for the period ending September 30, 1988.** Oak Ridge National Lab., TN (USA). Apr 1989. 335p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. (ORNL/M–798). Order Number DE89013734/JAW. Available from NTIS, PC A15/MF A01 - OSTI; GPO Dep.

This paper discusses the following topics on fusion reactor materials: irradiation, facilities, test matrices, and experimental methods; dosimetry, damage parameters, and activation calculations; materials engineering and design requirements; fundamental mechanical behavior; radiation effects; development of structural alloys; solid breeding materials; and ceramics.

37760 (EUR-CEA-FC–1353) **Tore Supra first wall description and behaviour during the initial plasma experiments.** Grosman, A.; Achard, M.H.; Chappuis, P.; Cordier, J.J.; Deschamps, P.; Gauthier, E.; Lipa, M. Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. Sep 1988. 34p. Available from NTIS (US Sales Only), PC A03/MF A01.

TORE SUPRA is a large-size, high-field superconducting tokamak (B_{pol}=4.5T, R=2.37 m,a=0.8m). It has been completed in the beginning of 1988 and is starting its experimental operation. The plasma-wall interaction programme will be mainly devoted to obtaining very long pulses in the next future, i.e. the control of impurity content, power and particule exhaust. The design of the first wall items takes this into account. The inner wall is made of graphite tiles brazed on stainless steel tubes, the outer wall of stainless steel panels. Moreover, three graphite limiters and six ergodic divertor modules have already been installed. Each of these elements is water-cooled (T_{water}=150-230^{0}C, p=3.6MPa). Vessel pumping is achieved by means of three turbomolecular pumps providing 9000l/s H_2 pumping speed. A 250^{0}C baking capability of the vessel is also available. First operations were mainly devoted to conditioning and carbonizing the whole plasma chamber, with RG discharges, allowing to work in homogeneous conditions. The first tokamak discharges are studied for a better knowledge of plasma control and stability in this configuration. Then, power deposition will be particularly investigated so as to prepare for the next steps: additional power and pump limiter operation.

37761 (GA-A–19684) **DIII-D power supply fault system.** Vanderlaan, J.F.; Smith, T.L. General Atomics Co., San Diego, CA (USA). Jun 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-890545–5: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA, USA, 15-18 May 1989). Order Number DE89014030/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The DIII-D tokamak magnetic confinement fusion device at General Atomics has been equipped with a power supply fault system which provides orderly shutdown in case of any of a number of faults. The nature of the fault dictates the extent of the shutdown required. CAMAC hardware accumulates data and triggers computer acquisition of diagnostic information. The system speeds diagnosis and repair of problems. 6 refs.

37762 (GANIL-P–88-16) **Explosions in Landau Vlasov dynamics.** Suraud, E.; Grand Accelerateur National d'Ions Lourds; , 14 - Caen; Cussol, D.; Gregoire, C.; Boilley, D.; Pi, M.; Schuck, P.; Remaud, B.; Sebille , F. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1988. 17p. (CONF-8810261–: International workshop on nuclear dynamics at medium and high energies, Bad Honnef, Germany, F.R., 10-14 Oct 1988;KVI–771). Order Number DE89789225/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

A microscopic study of the quasi-fusion/explosion transition is presented in the framework of Landau-Vlasov simulations of intermediate energy heavy-ion collisions (bombarding energies between 10 and 100 MeV/A). A detailed analysis in terms of the Equation of State of the system is performed. In agreement with schematic models we find that the composite nuclear system formed in the collision does explode when it stays long enough in the mechanically unstable region (spinodal region). Quantitative estimates of the explosion threshold are given for central symmetric reactions (Ca+Ca and Ar+Ti). The effect of the nuclear matter compressibility modulus is discussed.

37763 (INIS-BR–1549) **Controlled thermonuclear fusion in TOKAMAK type reactors, the European example: Joint European Torus (JET).** Paris, P.J.; Yassen, F.; Assis, A.S. de; Raposo, C. Universidade Federal Fluminense, Niteroi, RJ (Brazil). Jul 1988. 41p. (In Portuguese). Order Number DE89618739/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The development of controlled thermonuclear reaction in TOKAMAK type reactors, and the main projects in the world are presented. The main characteristics of the JET (Joint European Torus) program, the perspectives for energy production, and the international cooperation for viable use of the TOKAMAK are analysed. (M.C.K.).

37764 (INIS-SU–86/A, pp. 30-34) **To the problem of thermal stability of a stellarator reactor.** Dyabilin, K.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i

Tekhnike. 1988. (In Russian). In *Thermonuclear synthesis. Scientific-technical collection.* Order Number DE89012166/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

The problem of thermal stability of a self-sustained thermonuclear deuterium tritium reaction in stellarator reactors is considered. On the basis of equations of energy and particle balance criterion of reaction stability is obtained. Using neoclassical model of transfer analysis of reaction stability in stellarator reactors is made. It is shown that from the viewpoint of thermal balance thermonuclear self-sustained deuterium-tritium reaction in the stellarators is stable. Some results of the work are considered as applied to the reactor-tokamak type systems. 3 refs.

37765 (INIS-SU–86/A, pp. 7-9) **Chamber cleaning by glow discharge as a means of the outgassing rate reducing under fast hydrogen atom beam irradiation.** Zhil'tsov, V.A.; Kucheryaev, Yu.A.; Panov, D.A.; Rabin, A.A.; Skovoroda, A.A.; Tarabrin, Yu.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Thermonuclear synthesis. Scientific-technical collection.* Order Number DE89012166/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

Processes of gas desorption from walss play important role in experiments on the accumulation of ion-hot plasma in open traps. Therefore, a decrease in gas evolution during fast atom beam injection pulse seems urgent. Data on the interaction of a powerful beam of injected atom with the receiver material under experimental conditions in thermonuclear facility are rather scanty. Experiment on long-term purification of the Ogra-4 vacuum chamber by glow discharge in argon and on the measurement of beam atom implantation coefficient as a result is described. It is shown that using the vacuum technique (without heating) the implantation of hydrogen atoms with a factor of 0.7 can be attained. 3 figs.

37766 (INIS-SU–86/A, pp. 9-12) **Internal shielding of thermonuclear reactors.** Zimin, S.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Thermonuclear synthesis. Scientific-technical collection.* Order Number DE89012166/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

Using the criterion of dose restriction at the shielding output the optimization of two- and three-zone shieldings is realized. Optimization results of two-zone shielding on the basis of criterion of fluence restriction for neutrons with $E>0.1$ MeV at the shielding output and criteria for dose restriction in magnetic insulation are compared. For several three-zone shieldings the calculation of the number of displacements in copper stabilizing conductor at the shielding output is presented. On the basis of the calculations criteria for dose restriction in magnet insulation and restrictions of the number of displacements in the copper stabilizing conductor are compared. 5 refs.; 5 figs.

37767 (INIS-SU–86/A, pp. 28-29) **Plasma circuit breaker in a magnetic field as a high-power ion flux generator.** Golovanov, Yu.P.; Dolgachev, G.I.; Zakatov, L.P.; Skoryupin, V.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Thermonuclear synthesis. Scientific-technical collection.* Order Number DE89012166/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

It is ascertained that plasma circuit breaker (PCB) in the external magnetic field of acute-anguled geometry in the mode when PCB serves as inductive storage loading is a natural magnetoizolated diode. Using PCB as an ion emitter and as a high-voltage generator it proved possible in case of full electron magnetiuzation to attain the maximum efficiency of the storage. The density of ion current evaluated by the measured energy density for 30 J/cm^2 thermocouple and by the energy of 1.5 MeV constitutes 100 A/cm^2. The given method of ion generation is very effective when high ion currents with a high energy are required. 2 refs.

37768 (INIS-SU–86/A, pp. 45-48) **Probe measurements in the gas descharge plasma of a negative hydrogen ion source.** Antipov, S.P.; Elizarov, L.I.; Martynov, M.I.; Chesnokov, V.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Thermonuclear synthesis. Scientific-technical collection.* Order Number DE89012166/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

For the case of multicomponent gas discharge plasma with a high relative density of hydrogen negative ions the methods is suggested and results of volt-ampere characteristics (VAC) treatment of the Langmuir single probe are give. For VAC treatment additional information on relative currents of plasma positive components to the probe is required, as well as fulfilment of the condition $n_H\text{-}/n_e >> (T_e/T_+)^{1/2} >> 1$. VAC for the Langmuir probe were obtained by drawing a curve through a set of experimental points U_3 (voltage on the probe), I_3 (current in the probe circuit), using the least square fit. For the most characteristic operation mode of the source the following results are obtained: $T_e \simeq 3.82$ eV; $T_+ \simeq 1.06$ eV; $n_e \simeq 2.75 \times 10^{10}$ cm^{-3}; $n_H \simeq 209.12 \times 10^{10}$ cm^{-3}. 6 refs.; 2 figs.

37769 (INIS-SU–86/A, pp. 3-6) **Neutron generator based on adiabatic trap.** Golovin, I.N.; Zhil'tsov, V.A.; Panov, D.A.; Skovoroda, A.A.; Shatalov, G.E.; Shcherbakov, A.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Thermonuclear synthesis. Scientific-technical collection.* Order Number DE89012166/JAW. Available from NTIS (US Sales Only), PC A04/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3.

A possibility of 14 MeV neutron generator (NG) production on the basis of axial-symmetric adiabatic trap with MHD cusped armature for the testing of materials and elements of the DT reactor first wall and blanket structure is discussed. General requirements to NG are formulated. It is shown that the NG variant discussed meets the requirements formulated. Approximate calculation of the NG parameters has shown that total energy consumption by the generator does not exceed 220 MW at neutron flux specific capacity of 2.5 MW/m^2 and radiation test area of 5-6 m^2. 12 refs.; 2 figs.

37770 (LA-UR–89-2205) **KrF lasers for inertial confinement fusion.** Harris, D.B.; Cartwright, D.C.; Figueira, J.F.; McDonald, T.E.; Sorem, M.E. Los Alamos National Lab., NM (USA). 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890711–1: 5. international conference on emerging nuclear energy systems: ICENES '89, Karlsruhe, Germany, F.R., 3-6 Jul 1989). Order Number DE89014272/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The KrF laser has been proposed for inertial confinement fusion (ICF) since its discovery in 1975. Since that time, the laser has seen significant development and has been increased in energy many orders of magnitude to the several kilojoule energy level. The suitability of the KrF laser as a driver for ICF energy applications has been continually reviewed. The latest assessments indicate that the KrF laser still appears to be the leading laser candidate. A worldwide effort exists to advance the KrF laser for ICF applications. 21 refs., 1 fig.

37771 (LA-UR–1909) **Performance of the 10kV, 100-kA pulsed-power modules for the FRX-C magnetic compression experiment.** Rej, D.J.; Waganaar, W.J. Los Alamos National Lab., NM (USA). 1989. 5p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890665–31: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89014027/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this paper, we present detailed performance data collected from over a year's operation of the 25 and 50-kJoule pulsed-power capacitor-bank modules developed for the Los Alamos magnetic fusion facility FRX-C. These modules supply the 5-MA magnet current

needed for the compressional heating of compact toroid plasmoids. To date, 54 modules have been built and successfully tested at their full design rating: 100-kA peak output current at 10-kV charge, $\tau_{1/4}$ = 60 μs (25-kJ module), or 110 μs (50-kJ module), crowbar L/R < 1 ms. Modules are compact, cost about $5000 each, and though designed for 25 or 50 kJ, they can be easily modified for other pulsed-power applications. Energy is stored in 25-kJ capacitors. Start and crowbar switching is performed with a pair of water-cooled, size-D ignitrons. As an alternative to an ignitron, crowbar switching by solid-state rectifiers has been successfully demonstrated. Current is conducted between components and to the load by parallel-plate transmission lines and by a parallel array of commercially-available coaxial cable. 4 refs., 8 figs.

37772 (PPPL–2625) **Formulation and solution of the delayed gamma dose rate problem using the concept of effective delayed gamma production cross section.** Liew, S.L.; Ku, L.P. Princeton Univ., NJ (USA). Plasma Physics Lab. Jun 1989. 36p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE89014602/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

With appropriate approximations, the delayed gamma dose rate problem can be formulated in terms of the effective delayed gamma production cross section. The coupled neutron-delayed-gamma transport equations then take the same form as the coupled neutron-prompt-gamma transport equations and they can, therefore, be solved directly in the same manner. This eliminates the need for the tedious and error prone flux coupling step in conventional calculations. Mathematical formulation and solution algorithms are derived. The advantages of this method are illustrated by an example of its application in the solution of a practical design problem. 62 refs., 10 figs., 1 tab.

37773 (SAND–88-3437C) **Interstage closure times for the rimfire multistage gas switch.** Turman, B.N.; Humphreys, D.R.; Richards, C.N. Sandia National Labs., Albuquerque, NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890665–18: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89013815/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Rimfire multistage switch is a low-jitter SF_6 insulated gas switch that has been developed for PBFA II. The first stage is laser-triggered, and the subsequent stages are self-fired by the over-voltage from the closure of the triggered stage. The runtime of the 5 MV PBFA II switch is approximately 30 ns, and the standard deviation timing jitter is 1 ns. A Thomson streak camera and cylindrical imaging optics have been used to observe stage closure times, and a gated, single-frame camera recorded snapshots of the discrete arcs during the closure. These observations have shown that approximately half the switch closure time comes from the trigger and first self-break gap. The switch jitter is also dominated by these first gaps. Computer simulations, based on T.H. Martin's empirical gas breakdown model, agree with the experimental measurements, and give insight to the dynamics of the switch closure process. 9 refs., 8 figs., 2 tabs.

37774 (SAND–89-0007C) **Performance of plasma opening switches for the Particle Beam Fusion Accelerator II (PBFA II).** Rochau, G.E.; McDaniel, D.H.; Mendel, C.W.; Sweeney, M.A.; Moore, W.B.S.; Mowrer, G.R.; Simpson, W.W.; Zagar, D.M.; Grasser, T.; McDougal, C.D. Sandia National Labs., Albuquerque, NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890665–20: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89013816/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

During 1987 and 1988, Plasma Opening Switch (POS) experiments have been continued with the goal of providing voltage and power gain on the PBFA II ion beam accelerator at Sandia National Laboratories. The experiments have developed a POS that has a rugged plasma source, will open rapidly, and will couple to a high-impedance load. The initial erosion switch design with improved plasma uniformity does not couple to these loads. Therefore, we have abandoned further development of this switch for voltage and power gain. Three alternate designs have been developed, tested, and are found to have better performance with the high-impedance loads. These new switches employ magnetic fields to control and confine the injected plasma. A summary of the switch configurations, their theory of operation, and the experimental results is presented and discussed. 4 refs., 10 figs.

37775 (SAND–89-0275C) **Development of the BOLVAPS [Boil-Off Lithium VAPor Source] lithium vapor source for the PBFA-II [Particle Beam Fusion Accelerator II] accelerator.** Dreike, P.L.; Appel, D.B.; Cap, J.S.; Gerstle, F.P.; Lamppa, K.P.; Mattox, D.M.; McCollister, H.L.; Moore, R.H.; Neilsen, M.K.; Peeples, C.R. Sandia National Labs., Albuquerque, NM (USA). 1989. 16p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890703–8: International conference on ion sources, Berkeley, California, USA, 9-15 Jul 1989). Order Number DE89014495/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A pulsed, large area, Li vapor source for use in the PBFA-II ion beam diode is described. BOLVAPS produces a 1–2 mm thick layer of Li vapor with a density approaching 1×10^{17} cm^{-3} by rapid ohmic heating of a thin film laminate, one layer of which contains Li. The principal design issues of the vapor source being built for use on the PBFA-II accelerator are described. Results of small-scale development experiments are summarized. 5 refs., 4 figs.

37776 (SAND–89-0354C) **Ion production on the PI-110A accelerator.** McKay, P.F.; Bieg, K.W.; Olson, R.E.; Pregenzer, A.L.; Wiemann, D.K. Sandia National Labs., Albuquerque, NM (USA). 1989. 17p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890703–4: International conference on ion sources, Berkeley, California, USA, 9-15 Jul 1989). Order Number DE89013064/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Lithium ion and proton source experiments have been performed using an extraction geometry Applied-B ion diode on the 0.02-TW PI-110A accelerator. These sources are being developed for use in Inertial Confinement Fusion (ICF). The proton source relies on surface flashover to form an anode plasma from which the protons are drawn. The lithium sources seem to depend upon the local electric field for operation. The applied electric field was enhanced in the experiment by the geometry of the anode surface. For the proton source, ion generation was reduced when the applied magnetic field was increased. By contrast, lithium ion generation continued to increase as the applied magnetic field was increased. The effect of anode temperature was investigated for two lithium sources and was found not to be a factor in ion generation. 13 refs., 3 figs.

37777 (SAND–89-0894C) **External ion beam analysis of the TFTR [Tokamak Fusion Test Reactor] bumper limiters.** Walsh, D.S.; Knox, J.M.; Doyle, B.L. Sandia National Labs., Albuquerque, NM (USA). 1989. 14p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8906161–2: Ion beam analysis conference, Kingston, Canada, 26-30 Jun 1989). Order Number DE89014136/JAW. Available from NTIS, PC A03/MF A01; OSIT; GPO Dep.

Following the 1988 operational campaign of the Tokamak Fusion Test Reactor (TFTR), 63 bumper limiter tiles were removed for analysis. Each tile was analyzed ex-vacuo for deuterium contamination. The total deuterium content was obtained using a new two-point approximation technique for exponential depth profiles. Several tiles were further analyzed to provide detailed two and three dimensional mapping and line scans down the sides of tiles for deuterium. Comparison of the deuterium data for the 1987 and 1988 campaigns indicates that deuterium deposition does not depend solely upon total integrated fueling. D fueling for the 1988 campaign was comparable to proposed fueling for future DT shot scenarios in TFTR. 1988 deuterium data lead to a tritium inventory estimate of ~3 gm T in the limiter of TFTR for this fueling level. Scans along the side edges of limiter tiles indicate that the edges retain high levels of deuterium and are thus an important factor in T inventory estimates. 6 refs., 4 figs.

37778 (SAND–89-1390C) **Electrohydrodynamically driven, large-area liquid metal ion source for inertial confinement fusion.** Pregenzer, A.L. Sandia National Labs., Albuquerque, NM

(USA). 1989. 16p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890703–2: International conference on ion sources, Berkeley, California, USA, 9-15 Jul 1989). Order Number DE89012665/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Analysis of the electrohydrodynamic (EHD) equations of motion of a planar liquid-lithium surface in the presence of a normal electric field suggest that liquid lithium may provide a large-area ion source for intense ion-beam diodes. Such sources are being developed for the Particle Beam Fusion Accelerator II at Sandia National Laboratories. In this paper, theoretical and experimental studies of the planar EHD ion source will be reviewed. When a planar liquid surface is subjected to an electric field of sufficient magnitude, EHD instabilities produce an array of cusps on the surface. The electric field enhancement at the apex of each cusp is sufficient to permit field evaporation of ions. The time delay between application of the electric field and ion emission depends on the magnitude and rate of increase of the applied electric field, and on the initial amplitude of the surface perturbation. Above 10 MV/cm, theory indicates that field emission will occur on a nanosecond time scale and that the characteristic spacing of emitters will be less than one micrometer. At these fields, the source should have an intrinsic divergence of less than 6 mrad and the effects of space charge from neighboring emitters should not inhibit emission significantly. Experimental measurements of wavelength and cusp-formation-times for water and ethanol at electric fields near the critical field for instability have agreed well with theory. 11 refs., 4 figs.

37779 (SAND–89-1495C) **Status of light ion approach inertial confinement fusion.** VanDevender, J.P. Sandia National Labs., Albuquerque, NM (USA). 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8906148–2: Fusion Power Associates annual meeting, Washington, DC, USA, 1-2 Jun 1989). Order Number DE89013567/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Personnel at Sandia National Laboratories, the Naval Research Laboratory, Cornell University, and Los Alamos National Laboratory are developing cost effective beams of lithium ions to bridge the energy gap between lasers and underground nuclear explosions in the national Inertial Fusion Program. We plan to probe the threshold for igniting thermonuclear fuel in the laboratory on the Particle Beam Fusion Accelerator II (PBFA II). We have met our April 1, 1989, milestone of 5 trillion watts per square centimeter power density on PBFA II. We wish to adapt the existing Hermes III accelerator at Sandia into a pre-prototype module of the DOE Laboratory Microfusion Facility for military applications in support of the DOE decision in the mid 90s on the best particle beam or laser for the facility. A German-American study concludes that our lithium ion approach offers the lowest cost option for fusion energy. 7 figs.

37780 (SAND–89-1522C) **Ion diode experiments on PBFA [Particle Beam Fusion Accelerator] II: Workshop on applications of high power switching.** Stinnett, R.W.; Lockner, T.R.; Johnson, D.J.; Coats, R.S.; Mehlhorn, T.A.; Desjarlais, M.P.; Bieg, K.W.; Pregenzer, A.L.; Woodworth, J.R.; Leeper, R.J. Sandia National Labs., Albuquerque, NM (USA). 1989. 20p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890796–1: International workshop on high power opening switches, Novosibirsk, USSR, 1-2 Jul 1989). Order Number DE89014177/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Ion diode research on Sandia National Laboratories' Particle Beam Fusion Accelerator (PBFA) II has progressed significantly during the past two years as we have operated in the shot-a-day model with well-diagnosed proton and lithium ion diode loads. During this period, we have succeeded in demonstrating efficient proton beam generation and in focusing the beam to a full width at half maximum (FWHM) spot size of 5.2 mm. Power and energy densities equivalent to 5.4 (+0.9, −0.8) TW/cm^2 and 73 kJ/cm^2, respectively, on a 6 mm diameter sphere from the full diode were obtained. Tests of ion diode operation with a simple Plasma Opening Switch (POS), opening at a current of 1-2 MA, indicate efficient energy coupling and a rapid turn on of iron when the POS opens. A model of diode operation has been developed which successfully describes the operating impedance of applied-B ion diodes on PBFA II, PBFA I, Proto II, and Proto I. In addition, we have developed the capability to perform particle simulations which have helped to determine optimized insulating magnetic field profiles and anode shapes for efficient ion beam generation and focusing. Lithium ion source experiments on PBFA II have succeeded in delivering 26 kJ of lithium ions to the axis using a field-enhanced LiF ion source. Several active lithium ion sources, which should allow improved lithium began generation and focusing, are now being prepared for testing on PBFA II. 11 refs., 10 figs., 2 tabs.

37781 (UCRL–101023) **Chiral organic crystals for high power frequency conversion.** Davis, L.E.; Velsko, S.P.; Eimerl, D. Lawrence Livermore National Lab., CA (USA). 5 May 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8809364–1: Sessions on materials processing in space, Chicago, IL, USA, 25-28 Sep 1988). Order Number DE89013791/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Water soluble organic salts comprise a class of crystalline materials containing many efficient harmonic generators for high power lasers. Statistical studies of the simple chiral salts reveal that approximately ten percent have nonlinearities similar to or better than potassium dihydrogen phosphate, the material most commonly used for high power frequency conversion. Furthermore, high damage thresholds (> 40 J/cm^2 at 1.06 μm) have been demonstrated in 1-arginine phosphate which is a representative crystal from this class. Simple chiral salts have ultraviolet cutoff wavelengths of 200–500 nm, and this, together with the fact that many are very birefringent, implies that phasematching over a wide range of wavelengths should be possible. In particular, this class of materials may be expected to contain efficient harmonic generators of blue and ultraviolet light. Finally, very large single crystals (>1000 cm^3) of many of these water soluble materials can be grown, making the fabrication of large aperture frequency conversion devices possible. 15 refs.

37782 (UCRL–101266) **Multi-segment Nd:Glass disk amplifiers.** Murray, J.E.; Erlandson, A.C.; Frick, F.A.; Jancaitis, K.S.; Hurley, C.E.; Powell, H.T. Lawrence Livermore National Lab., CA (USA). 6 Jun 1989. 22p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890423–11: CLEO '89: conference on lasers and electro optics, Baltimore, MD, USA, 24-28 Apr 1989). Order Number DE89014043/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Initial designs of a multi-megajoule laser system call for compact, segmented aperture disk amplifiers which are substantially different from conventional amplifiers. We have experimentally investigated several of the new issues introduced by these amplifiers. 2 refs., 1 fig.

37783 Spacecraft charging potential during electron-beam injections into space plasmas. Lin, C.S. (Dept. of Space Sciences, Southwest Research Institute, San Antonio, TX (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA),* 17(2): 205-209 (Apr 1989).

Injections of nonrelativistic electron beams from an infinite conductor have been simulated by using a two-dimensional electrostatic particle code to study the spacecraft charging potential. The simulations show that the conductor charging potential at the end of simulations does not vary with the beam density when the beam density exceeds four times the ambient density. The reflection coefficient, which determines a percentage of incident electrons reflected by the conductor, increases the charging potential. To charge the conductor to the beam energy, the reflection coefficient needs to be about 0.5. The results are applied to explain the spacecraft charging potential measure during the SEPAC experiments from Spacelab 1.

37784 Axisymmetric particle-in-cell simulations of diamagnetic-cavity formation in vacuum. Gisler, G. (Space Plasma Physics ESS-8, Los Alamos National Lab., Los Alamos, NM (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA),* 17(2): 210-219 (Apr 1989).

Axisymmetric simulations of the expansion of a hot plasma suddenly introduced into a vacuum containing a weak magnetic field were performed using an electromagnetic particle-in-cell code. Both uniform and gradient fields have been used, with the simulation axis along the principle field direction. The formation of a diamagnetic

cavity requires an initial plasma $\beta > 1$; as the expansion proceeds, β diminishes, and the field eventually recovers. The maximum spatial extent of the cavity and its duration can be obtained from simple dynamical considerations. Field-aligned ion acceleration behind the electron front is observed in all field geometries and strengths. In the case of expansion into a divergent field, the plasma is found to move down the field gradient by ambipolar diffusion. These simulations are relevant to active release experiments in the Earth's magnetosphere, to pellet ablation experiments, and to the naturally occurring diamagnetic bubbles observed at the Earth's foreshock.

37785 The dynamics of charged particles in the near wake of a very negatively charged body. Morgan, M.A. (Northeastern Univ., 235 Forsyth Bldg., Boston, MA (US)); Chan, C.; Cooke, D.L.; Tautz, M.F. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA),* 17(2): 220-227 (Apr 1989).

A numerical simulation that is cylindrical in configuration space and 3-D ($upsilon_x$, $upsilon_y$, $upsilon_z$) in velocity space has been initiated to test a model for the near-wake dynamics of a very negatively charged body. The simulation parameters were closely matched to those of a laboratory experiment so that the results may be compared directly. It was found from the laboratory study that the electrons and ions can display different temporal features in the filling-in of the wake; and that they both can be found in the very near-wake region (within one body diameter) of an object with a highly negative body potential. The authors have also found that the temperature of the electrons in the very near wake could be somewhat colder than the ambient value, suggesting the possibility of a filtering mechanism being operative there. The simulation results to data largely corroborate the density findings in terms of the presence of an enhancement for both ions and electrons and in its location. There is reason to think too that additional agreements can be realized if two key elements - the inclusion of a 2-component, source electron distribution in the simulation and an understanding of the perturbation imposed by the diagnostic probe itself on the experiment - can be achieved. This is an ongoing process. Results from both the laboratory experiment and the numerical simulation are presented, and a model that accommodates these findings is discussed.

99 GENERAL AND MISCELLANEOUS

Refer also to citation(s) 35847, 35848, 36892, 37018, 37792

9901 Management

Refer also to citation(s) 35839, 35840, 36269, 37227, 37401

37786 (CNEA-NT–6/88) **Summary of activities of the Research Department 1984.** Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 18 May 1989. 109p. (In Spanish). Order Number DE89620470/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

This annual report of the Research Department describes the activities performed during 1984 in the following fields: Physics, Reactor Chemistry, Radiobiology, Prospective and Special Studies, Biomathematics, Labelled Molecules and Radiochemistry. During this period the first heavy ion beam in the accelerator Tandar was obtained. A list of publications made by the Department this year is enclosed. (M.E.L.).

37787 (CONF-8902105–Summs.) **Proceedings of the DOE quality conference: Managing for quality in a changing environment.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Quality Programs. 1989. 258p. Sponsored by DOE Environment Health & Safety. From DOE quality conference: managing for quality in a changing environment; Albuquerque, New Mexico, USA; 14-16 Feb 1989. Order Number DE89012866/JAW. Available from NTIS, PC A12/MF A01 - OSTI.

The purpose of the conference was to effect change and improve safety and quality of DOE operations by providing managers with lessons learned from DOE and industry experiences. It also addressed new efforts in quality verification and the need for changing the quality culture within DOE. There was excellent response to the call for the DOE Quality Conference. Approximately 170 representatives from DOE Headquarters, operations offices, and contractors supported the overall conference and associated workshops. Almost 25% of these participants were line managers. The conference consisted of presentations and discussions revolving around four areas of interest: (1) the initiatives taken by the Department of Energy/Office of the Assistant Secretary for Environment, Safety and Health (DOE/EH) to achieve safety and quality; (2) methods employed by commercial organizations to achieve higher levels of quality; (3) lessons learned within DOE and commercial activities for safety and quality; and (4) initiatives for institutionalizing quality assurance (QA) at DOE laboratories. Four workshops were also conducted on topics suggested by the conference organizing committee.

37788 (INIS-mf–11449) **Tenth working group meeting of representatives of RCA Member States. Report.** International Atomic Energy Agency, Vienna (Austria). Apr 1989. 235p. (CONF-8804284–: 10. working group meeting of representatives of RCA Member States, Beijing, China, 11-14 Apr 1988). Order Number DE89620463/JAW. Available from NTIS (US Sales Only), PC A11/MF A01 - OSTI; INIS.

The Tenth RCA (Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology) Working Group meeting of representatives of RCA Member States was held at the Chinese Academy of Agricultural Sciences, Beijing, between 11-14 April 1988. The report on the meeting consists of a presentation of the seven technical sessions which dealt with topics such as nuclear techniques in industry, agriculture and medicine, nuclear power and of the project reports under RCA.

37789 (SAND–89-1029C) **Advanced Small Site Program.** Ringler, C.E. Sandia National Labs., Albuquerque, NM (USA). 1989. 6p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–17: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, Florida, USA, 9-12 Jul 1989). Order Number DE89014486/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Development of the Advanced Small Site Program (ASSP) will satisfy the requirement for a small to medium sized security system uses commercially available, low cost, state-of-the-art technology to enhance its performance. The system addresses all aspects of technical security. These aspects include control and display; perimeter and interior sensors; data and video transmissions; video assessment; reduced installation, operation, and maintenance costs. Major system features include use of multi-level graphics with touchscreen inputs to control all sensor and video functions. An optional feature allows the use of fiber optics for data or video transmissions. Integration of functional components into modular sub-systems eases the task of expanding, maintaining, and operating the system. The system's automatic restart function permits a fully loaded system to configure itself in less than ten minutes. Site personnel will be able to create and modify a configuration data file of the site. The ASSP software uses this file data to run its programs. The configuration file contains the number of sensors, sectors, buildings, cameras, sensor thresholds, sensor priorities,and other site specific information. An off-line program obtains this information through a series of queries to the site personnel. This information is written to a data configuration file. This paper describes the functions and integration of this system. 11 figs.

37790 (SAND–89-1108C) **Effective implementation of safeguards and security requirements.** Schumann, M.; Hofferth, L.J.; Trujillo, A.A. Sandia National Labs., Albuquerque, NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–18: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, Florida, USA, 9-12 Jul 1989). Order Number DE89014480/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Effective implementation of an insider protection program in light of the new directives can be accomplished through sound planning and a strong management commitment to meaningful improvements. Good planning, with a firm set of goals and objectives that have reasonable milestones, are essential elements in the effective implementation of new requirements. This paper describes a structured approach to achieving effective and acceptable program implementation.

37791 (SAND–89-1109C) **Demonstrations of a real time personnel and material tracking system.** Trujillo, A.A.; Hoover, C.E. Sandia National Labs., Albuquerque, NM (USA). 1989. 4p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–15: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, Florida, USA, 9-12 Jul 1989). Order Number DE89013810/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Past experience in addressing the insider threat has led to the development of general principles for mitigating the insider threat while minimizing adverse impacts on site operations. Among the general principles developed was the requirement for real time tracking of personnel and material. A real time system for personnel and material tracking will aid in mitigating the insider threat by providing critical information regarding the movement and location of personnel and material. In addition, this system can provide an early detection mechanism for potential insider actions. This paper describes the development, operation, and performance of a technology-based system which utilizes radio frequency transmitters to achieve the real time tracking of personnel and material. The major elements of this system are personnel tracking credential which cannot be removed from an authorized individual without an alarm being sounded, and material control device which is utilized to control and monitor access to material. These elements form an insider protection system through the use of software which establishes the "rules" under which the system will operate. The performance of this system has been evaluated under both laboratory and operational settings in order to: (1) demonstrate the system's ability to successfully control access to material and areas by personnel, and (2) provide information regarding the status of materials in transit and storage. 3 refs., 1 fig.

37792 (SAND–89-1609C) **An evaluation of the polyester/polyethylene badge packet as an identification card.** Wright, L.J. Sandia National Labs., Albuquerque, NM (USA). Jul 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–22: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, Florida, USA, 9-12 Jul 1989). Order Number DE89014493/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

With the advent of automated photographic badge making systems and automated access control systems, the need for new badge making strategies has become evident. In order to determine the suitability of the polyester/polyethylene badge packet for application to both the currently widely used Polaroid (TM) photographic process and the emerging automated photographic badge making process, Sandia National Laboratories procured samples of this type of badge packet from four different suppliers and evaluated them. The evaluation packet was designed to accommodate either process as well as an automated access control system (in this case, a system based on magnetic stripe technology). The evaluation consisted of environmental, mechanical, chemical and magnetic tests to determine reliability and durability. These tests included a flex test at −20°F, 76°F and 125°F; a washing machine test; a magnetic stripe wear test; an outdoor test; and a high magnetic field exposure test. These tests were designed to simulate conditions the badge might encounter during normal use. 5 tabs.

37793 (TVA/PUB–88/18) **Office of the Inspector General: Semiannual report, October 1, 1988–March 31, 1989.** Tennessee Valley Authority, Knoxville, TN (USA). 30 Apr 1989. 62p. Sponsored by Tennessee Valley Authority. Order Number DE89014205/JAW. Available from NTIS, PC A04/MF A01 - OSTI.

This is the sixth Semiannual Report for the Office of the Inspector General (OIG). It summarizes our major activities and accomplishments from October 1, 1988 to March 31, 1989. During this reporting period, we issued 24 final audit reports and identified more than $7.7 million in questioned costs and $22.5 million in funds that could be put to better use. We also issued 169 formal investigative reports and 6 project reports to TVA management and referred over 80 matters to federal or state prosecutors or other government officials. A number of our investigations – particularly those involving workers' compensation benefits – have demonstrated their cost-savings potential. For example, this report describes OIG investigations that may ultimately save TVA more than $2.2 million in avoided workers' compensation benefits. Because we focus on ways to improve TVA programs and operations, we may also identify instances of questionable conduct, needed improvements, or opportunities for positive change. However, any shortcomings identified in this report should not be viewed as characteristic of all TVA operations or as a representative of TVA employees generally. Moreover, as a careful reading of this report will confirm, a significant number of our audits, investigations, and other activities reach conclusions that are generally favorable to TVA management and employees.

9902 Mathematics and Computers

Refer also to citation(s) 35575, 35640, 35735, 35838, 35843, 35845, 35847, 35848, 35849, 35850, 35851, 35941, 35954, 35973, 35993, 36001, 36007, 36009, 36018, 36020, 36021, 36030, 36031, 36047, 36068, 36071, 36077, 36078, 36079, 36084, 36086, 36092, 36094, 36098, 36109, 36110, 36132, 36154, 36159, 36160, 36163, 36168, 36187, 36188, 36189, 36210, 36254, 36257, 36341, 36358, 36359, 36372, 36373, 36381, 36385, 36397, 36403, 36417, 36432, 36443, 36448, 36579, 36730, 36732, 36852, 36870, 36871, 36879, 36881, 36885, 36886, 36889, 36890, 36893, 36916, 36923, 36974, 37000, 37002, 37014, 37015, 37020, 37028, 37062, 37076, 37085, 37086, 37103, 37106, 37120, 37147, 37151, 37153, 37156, 37248, 37321, 37322, 37330, 37415, 37478, 37479, 37480, 37484, 37549, 37626, 37690, 37709, 37749, 37819, 37820

37794 (AD-A–204860/1/XAB) **Randomized parallel branch-and-bound algorithm.** Janakiram, V.K.; Agrawal, D.P.; Mehrotra, R. North Carolina State Univ., Raleigh, NC (USA). 1988. 9p. Available from NTIS, PC A02/MF A01.

Pub. in Proceedings of the International Conference on Parallel Processing, 69-75(1988).

A new technique for the parallel execution of branch-and-bound algorithms using randomization is proposed. The algorithm requires relatively little inter-processor communication, while achieving good speedups over the uniprocessor execution times; in precisely those cases where the problem size becomes very large, randomization is found to be extremely successful in achieving very good speedups. A probabilistic model was devised to explore the effectiveness of this technique, and to estimate the expected speedups that could be obtained. The model was validated by extensive simulation work on a multiprocessor simulator. Besides being very simple to implement, the technique also ensures high reliability, flexibility, and fault tolerance.

37795 (AD-A–204907/0/XAB) **Expert systems on multiprocessor architectures. Phase 1. Final report, March 1985-July 1987.** Feigenbaum, E.A.; Engelmore, R.S. Stanford Univ., CA (USA). Knowledge Systems Lab. Aug 1988. 325p. Available from NTIS, PC A14/MF A01.

The military has a demonstrated need for knowledge-based systems with significantly higher quantitative performance. The current hardware and software architectures for knowledge-based systems cannot support such requirements. Based on near-term projections for integrated-circuit technologies, it is clear that highly parallel multiprocessor computers consisting of 100s to 1000s of processors and realizing a variety of concurrent architectures can be built. The most-promising approach for achieving orders of magnitude improvement in the quantitative performance of knowledge-based systems is by exploiting concurrency on multiprocessor systems. The major issue is whether such computer systems can be effectively used to enhance the performance of knowledge-based systems. Expert systems on Multiprocessor Architectures project is addressing the following questions: (1) Can multiprocessor computers be used to achieve significant execution speedup (two to three orders of magnitude) over serial machines for knowledge-based system applications. (2) What are the limiting factors in achieving speedup for such systems. (3) What are appropriate software models and methodologies for programming such systems. (4) What are appropriate hardware architectures for supporting such systems. Given the lack of any formal foundations for studying concurrent knowledge-based systems, the approach taken to answering these questions is empirical rather than theoretical.

37796 (AD-A-204915/3/XAB) **Parallel problem-solving system, PRISM (Parallel Inference System). Final report, November 1986-February 1988.** Minker, J. Maryland Univ., College Park, MD (USA). Dept. of Computer Science. 19 Apr 1988. 12p. Available from NTIS, PC A03/MF A01.

A parallel problem-solving system, PRISM (Parallel Inference System), that was implemented on the VAX/11-780, the PYRAMID and SUN machines, was ported successfully to McMOB and then to the BBN Butterfly parallel architecture. The McMOB architecture is essentially the ZMOB architecture with 16 Motorola 68000 processors, upgrading the Z80A microprocessors, interconnected in a ring structure. Experimental testing of PRISM on McMOB was undertaken. In addition, several enhancements were made to PRISM to permit experimental analyses to be made, and to incorporate additional features to take full advantage of parallelism in a problem-solving environment. The tracing and statistical gathering packages were extended. An ability to display AND-parallelism was added to the trace program, which displays the execution of a program on the parallel machines. Heuristic techniques were developed to determine which information to display to a user. The system software for ZMOB/McMOB is now robust and considered completed. This has allowed the author to re-emphasize studies on parallel software. A new formalism for slicing/splicing was developed that eliminates much of the run-time overhead of the technique, allowing for the development of a splicing compiler. Work has also focused on the development of debugging tools for parallel software and the integration of artificial-intelligence techniques into debugging software.

37797 (AD-A-205184/5/XAB) **Developing software to use parallel processing effectively. Final report, June-December 1987.** Center, J. Dynamics Research Corp., Andover, MA (USA). Oct 1988. 199p. Available from NTIS, PC A09/MF A01.

This report describes the difficulties involved in writing efficient parallel programs and describes the hardware and software support currently available for generating software that utilizes processing effectively. Historically, the processing rate of single-processor computers has increased by one order of magnitude every five years. However, this pace is slowing since electronic circuitry is coming up against physical barriers. Unfortunately, the complexity of engineering and research problems continues to require ever more processing power (far in excess of the maximum estimated 3 Gflops achievable by single-processor computers). For this reason, parallel-processing architectures are receiving considerable interest, since they offer high performance more cheaply than a single-processor supercomputer, such as the Cray.

37798 (CONF-890744-2) **A virtual zero-time, monolithic systolic sorting array.** Britton, C.L.; Ericson, M.N.; Bouldin, D.W. Oak Ridge National Lab., TN (USA). 1989. 12p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From VLSI education conference and exposition; Santa Clara, California, USA; 19-21 Jul 1989. Order Number DE89007515/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A virtual zero-time monolithic sorting chip is described. The chip has a systolic array architecture and implements the "sinking sort" algorithm. The basic functional module of the systolic array is detailed and development techniques employed as well as functional simulation and results are presented. Lessons learned and educational significance of the development of this chip at a university are discussed. 3 refs., 4 figs.

37799 (CONF-8906112-1) **Chaotic behavior in a new class of parallel optimization algorithms.** Culioli, J.C.; Protopopescu, V.; Mann, R.C. Oak Ridge National Lab., TN (USA). 1989. 11p. Sponsored by DOD;DOE/DP. DOE Contract AC05-84OR21400. From 7. symposium on energy engineering sciences; Argonne, Illinois, USA; 19-21 Jun 1989. Order Number DE89014069/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A new class of optimization algorithms for linear and nonlinear problems is proposed. The algorithms are based on sigmoidic updatings and can be looked upon as nonlinear multidimensional maps. The bifurcation and chaotic regimes of these maps are analyzed and their possible application to optimization problems are indicated. 9 refs., 3 figs.

37800 (CONF-8906150-1) **Electronic communication and data transfer productivity enhancements.** Truett, T.; Stevens, S. Oak Ridge National Lab., TN (USA). 1989. 12p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 3. international conference on microcomputers in transportation; San Francisco, California, USA; 21-23 Jun 1989. Order Number DE89013542/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Transportation projects can be small, local efforts or large, multisited ventures. For these large projects, electronic mail and data transfer are not merely productivity aids; they are indispensable components of success. Electronic communication via microcomputers is quick and convenient and provides documented evidence of the communication. The rapid exchange of cost data, routing data, plans and scheduled, and information on the availability of transportation equipment and personnel ensures maximum use of transportation assets and provides responsiveness to customer requests for transportation services. Large ventures operating from widely separated sites cannot depend on local area networks for their communication requirements, as can small, single-sited projects. Not all projects have access to established communication networks such as BITNET (used widely by universities) or DDN (the Defense Data network). In addition, transportation efforts that involve several diverse agencies such as the federal government, local officials, public utilities, industry, or the private sector have special communication requirements. This paper focuses on criteria for choosing an appropriate microcomputer based communication mechanism. Emphasis is placed on determining communication requirements and ranking the importance of system characteristics. Advantages and limitations of three distinct system configurations are discussed in nontechnical terms. 13 refs., 1 tab.

37801 (CTA-EAv-FTE-022/81) **ECIS - Adaptation to CDC CYBER system.** Nair, R.P.K.; Rego, R.A.; Lemos, B.J.K.C. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Atividades Espaciais. 30 Nov 1981. 11p. (In Portuguese). Order Number DE89620447/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The implantation of ECIS computer code, elaborated for BOURROUGHS 6700 computer of USP (Universidade de Sao Paulo), in the CDC CYBER 170/730 computer is presented. The ECIS code calculates cross section by coupled channel method. Some problems were calculated to verify the compactibility of results obtained from BOURROUGHS 6700 version with the version. The problems calculated by new version and the carried out modifications, are described (M.C.K.).

37802 (DOE/ER/25026-31) **Asynchronous integration of ordinary differential equations on multiprocessors.** Aslam, S.; Gear, C.W. Illinois Univ., Urbana, IL (USA). Dept. of Computer Science. Jul 1989. 31p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER25026. (UIUCDCS-R-89-1525;UILU-ENG-89-1744). Order Number DE89014169/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Asynchronous Iterations Methods have been shown to offer significant speedups in multiprocessing environments for the class of iterative methods $x = F(x)$. For a system of equations, parallel implementation on a multiprocessor with no minimal synchronization between cooperating processes yields the most advantage. Picard or Picard-like iteration schemes for solving Ordinary Differential Equations (ODEs) fall into such a class of iterative methods. The Picard method computes a sequence of successive approximation $y^n(t)$ to the exact solution $y(t)$ of the Initial Value Problem (IVP) $\dot{y} = f(t,y)$, $y(t_0) = y_0$, where $\dot{y} = dy/dt$. Starting with $y^0 = y(t_0)$, it can be shown that this sequence converges to the true solution $y(t)$ of the IVP. We have developed an asynchronous iterative procedure that performs such an integration in a multiprocessor environment. For a given system of n IVP, each component $\dot{y}t = f_i(t, y_1, y_2, \cdots, y_n)$ is integrated any time any of the y_j, $j \neq i$ gets updated. No synchronization other than this is maintained amongst the components. The algorithm has been implemented on an Encore Multimax which is a multiprocessor shared-memory machine. The computer code is designed to solve a given system of ODEs. The user interface to the code is similar to traditional ODEs solvers. We present a preliminary report on results obtained. 5 refs.

37803 (DOE/PE/70411–T2) **User's guide to CONVEST.** Graves, K.; Gaynor, W. Pechan (E.H.) and Associates, Inc., Springfield, VA (USA). Apr 1985. 66p. Sponsored by DOE Management & Administration. DOE Contract AC01-84PE70411. Order Number DE89014518/JAW. Available from NTIS, PC A04/MF A01 - OSTI.

CONVEST consists of a data entry and edit module – CONVEST – and a computation module – CONEVAL. The CONVEST model is referred to herein as CONVEST, as distinct from the CONVEST module, one of its components. The CONVEST model is designed to allow institutional energy managers to perform a rapid evaluation of alternative financing arrangements for the installation of capital improvements for energy conservation.

37804 (IPPJ-DT–144) **Experimental data processing techniques by a personal computer.** Matsuura, Kiyokata; Tsuda, Kenzo; Abe, Yoshihiko; Kojima, Tsuyoshi; Nishikawa, Akira; Shimura, Hitoshi; Hyodo, Hiromi; Yamagishi, Shigeru. Nagoya Univ. (Japan). Inst. of Plasma Physics. Jan 1989. 194p. (In Japanese). Order Number DE89790928/JAW. Available from NTIS (US Sales Only), PC A09/MF A01.

A personal computer (16-bit, about 1 MB memory) can be used at a low cost in the experimental data processing. This report surveys the important techniques on A/D and D/A conversion, display, store and transfer of the experimental data. It is also discussed the items to be considered in the software. Practical softwares programed BASIC and Assembler language are given as examples. Here, we present some techniques to get faster process in BASIC language and show that the system composed of BASIC and Assembler is useful in a practical experiment. The system performance such as processing speed and flexibility in setting operation condition will depend strongly on programming language. We have made test for processing speed by some typical programming languages; BASIC(interpreter), C, FORTRAN and Assembler. As for the calculation, FORTRAN has the best performance which is comparable to or better than Assembler even in the personal computer.

37805 (LA–11614-MS) **Lessons learned in the DOE Computer Security Enhancement Review Program.** Hunteman, W.J. Los Alamos National Lab., NM (USA). Jul 1989. 28p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE89014164/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the last 4 years, DOE has made the most detailed and extensive computer security self-evaluation of any US government organization. The breadth and depth of the examination have revealed some problems. Few of the problems are major; most are procedural, some administrative, a few technical, and almost none systemic. This report documents the lessons learned from one part of the evaluation process.

37806 (LA-UR–89-2087) **Numerical simulation of plasma opening switches.** Mason, R.J.; Jones, M.E.; Bergman, C.D. Los Alamos National Lab., NM (USA). 1989. 13p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890710–8: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk, USSR, 3-7 Jul 1989). Order Number DE89014296/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Plasma Opening Switches have been examined numerically with the aid of the ANTHEM plasma simulation model. A generic bicylindrical switch is studied. The switching of generator pulses ranging from 50 ns to 1 μsec is reviewed, for a variety of plasma fill lengths and densities, and for a range of resistive loads. 7 refs., 9 figs.

37807 (LA-UR–89-2130) **Los Alamos Center for Computer Security formal computer security model.** Dreicer, J.S.; Hunteman, W.J.; Markin, J.T. Los Alamos National Lab., NM (USA). 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890736–26: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, Florida, USA, 9-12 Jul 1989). Order Number DE89014221/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper provides a brief presentation of the formal computer security model currently being developed at the Los Alamos Department of Energy (DOE) Center for Computer Security (CCS). The need to test and verify DOE computer security policy implementation first motivated this effort. The actual analytical model was a result of the integration of current research in computer security and previous modeling and research experiences. The model is being developed to define a generic view of the computer and network security domains, to provide a theoretical basis for the design of a security model, and to address the limitations of present formal mathematical models for computer security. The fundamental objective of computer security is to prevent the unauthorized and unaccountable access to a system. The inherent vulnerabilities of computer systems result in various threats from unauthorized access. The foundation of the Los Alamos DOE CCS model is a series of functionally dependent probability equations, relations, and expressions. The model is undergoing continued discrimination and evolution. We expect to apply the model to the discipline of the Bell & LaPadula abstract sets of objects and subjects. 6 refs.

37808 (ORNL/TM–10714) **ORMONTE: An uncertainty analysis code for use with user-developed systems models on mainframe or personal computers: A user's guide.** Williams, K.A.; Hudson, C.R. II. Oak Ridge National Lab., TN (USA). May 1989. 196p. Sponsored by DOE Defense Programs. DOE Contract AC05-84OR21400. Order Number DE89013730/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

Documentation is provided for a general purpose uncertainty analysis code entitled ORMONTE. The code is intended to be linked with FORTRAN-77 models designed by the user. ORMONTE is capable of performing sequential single-variable sensitivity studies (SVSS), elasticity analyses, and multivariable sensitivity studies (MVSS) by acting as a driver on the user's model. The MVSS function utilizes the Monte Carlo simulation method of probabilistic analysis. The model accessed by the ORMONTE driver code and the names and characteristics of the modeler's uncertain variables are provided by the user. ORMONTE is essentially a bookkeeping code which keeps track of inputs and outputs defined by the user, samples the user-defined uncertainty distributions, repeatedly runs the user's model, and produces statistical data and output probability histograms for the output variables of interest to the user. ORMONTE has been utilized extensively by the USDOE and its Oak Ridge contractors, Martin Marietta Energy Systems Inc., and its predecessor, Union Carbide Corp.; Nuclear Division, for the economic evaluation of large-scale energy projects for which computer models have been constructed for performance and cost projection purposes. ORMONTE has been used on several computer systems including a Cray, several VAXes, two IBM-360 mainframes, and DOS compatible PCs (along with the appropriate FORTRAN-77 software). The detail documentation provided here deals mainly with the PC version to be utilized with RM/FORTRAN; however, installation on a mainframe is reasonably simple. An example problem and complete ORMONTE input and output therefrom are provided. 3 refs., 24 figs., 6 tabs.

37809 (SAND–88-3041C) **Computer site threat identification and analysis.** Clever, J.J. Sandia National Labs., Albuquerque, NM (USA). 1989. 25p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8905149–1: Digital Equipment Computer Users Society symposium, Atlanta, Georgia, USA, 8-12 May 1989). Order Number DE89013495/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A major early milestone in achieving a sound comprehensive computer security posture for a given site is the identification of both potential and actual threats, a necessary step in a framework for the overall site risk assessment process. This report addresses some considerations in identifying and differentiating among threats, agents which accomplish threats, and threat impacts. It includes some general rank/order modeling approaches to support a threat analysis and to provide input to a following risk analysis. 22 refs., 10 figs.

37810 (SAND–88-3089C) **Using conjoint meshing primitives to generate quadrilateral and hexahedral elements in irregular regions.** Stephenson, M.B.; Blacker, T.D. Sandia National Labs., Albuquerque, NM (USA). 6 Jan 1989. 33p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890741–1: ASME international computers in engineering conference, Anaheim, California, USA, 30 Jul - 2 aug 1989). Order

Number DE89005918/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The parameter-space mapping technique used in most finite element mesh generation programs requires that the geometry be subdivided into either rectangular areas in 2-D or rectilinear volumes in 3-D to produce, respectively, quadrilateral or hexahedral elements. Since subdivision occurs in parameter space, the edges bounding the areas and volumes need not be straight or parallel lines. Simple geometries may be subdivided easily while irregular features challenge the analyst. This paper presents the formulation and application of conjoint meshing primitives that assist the analyst in meshing in and around irregular features. The term conjoint is applied to these primitives because each is composed of several rectangular areas or rectilinear volumes. Interval assignments may vary from side to side, within a set of constraints, for each primitive. Thus, all of them are useful for transitions between other regular areas or volumes. In 2-D, the primitive areas are the triangle, pentagon, semi-circle, circle, and rectangular transition. These primitives are implemented in the Sandia meshing program FASTQ and are used in regular production work. They are also the basis for decomposition regions in the developing artificial intelligence Automated Meshing Knowledge System, AMEKS. In 3-D, the primitive volumes are the 2-D primitives extended in depth together with the tetrahedon and two rectilinear transition volumes. These primitives are the foundation for extending AMEKS to 3-D. 9 refs., 14 figs.

37811 (SAND–89-0008) **ELLIPSE user's manual and program reference.** Tardy, H.L. Sandia National Labs., Albuquerque, NM (USA). Mar 1989. 125p. Sponsored by DOE Energy Research. DOE Contract AC04-76DP00789. Order Number DE89014575/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

A new program, ELLIPSE, for the analysis of ellipsometric data is described. The program is interactive and includes on-line help, performs explicit error analysis for single-angle-of-incidence measurements, allows the input of four-zone null data, and performs least-squares analysis of multiple-angle-of-incidence data. Solutions for the transparent-film-on-substrate model are obtained using decoupled equations for film thickness and index. No initial guess is required for thickness, and the algorithm is insensitive to the initial guess for film index. This document combines the user's manual and program description for ELLIPSE, and includes several examples of its use. 11 refs.

37812 (SAND–89-1575C) **A solid state video recorder as a direct replacement of a mechanically driven disc recording device in a security system.** Terry, P.L. Sandia National Labs., Albuquerque, NM (USA). 1989. 11p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890736–6: 30. annual meeting of the Institute of Nuclear Materials Management, Orlando, FL, USA, 9-12 Jul 1989). Order Number DE89014780/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Whether upgrading or developing a security system, investing in a solid state video recorder may prove to be quite prudent. Even though the initial cost of a solid state recorder may be more expensive, when comparing it to a disc recorder it is practically maintenance free. Thus, the cost effectiveness of a solid state video recorder over an extended period of time more than justifies the initial expense. This document illustrates the use of a solid state video recorder as a direct replacement. It replaces a mechanically driven disc recorder that existed in a synchronized video recording system. The original system was called the Universal Video Disc Recorder System. The modified system will now be referred to as the Solid State Video Recording System. 5 figs.

37813 (UCRL–100959) **A MACSYMA package for the generation and manipulation of Chebyshev series.** Einwohner, T.H.; Fateman, R.J. Lawrence Livermore National Lab., CA (USA). 19 Apr 1989. 13p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890779–1: International symposium on symbolic and algebraic computing, Portland, Oregon, USA, 17-19 Jul 1989). Order Number DE89011404/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Techniques for a MACSYMA package for expanding an arbitrary univariate expression as a truncated series in Chebyshev polynomials and manipulating such expansions is described. A data structure is introduced to represent a truncated expansion in a set of orthogonal polynomials. The data structure contains the independent variable, the name of the orthogonal polynomial set, the number of terms retained, and a list of the expansion coefficients. Although we restrict attention here to the set of Chebyshev polynomials as the orthogonal set, extension to other orthogonal polynomials will be done later. A data structure for truncated power series is provided as an alternative. The principal function of the package converts a given expression into the aforementioned data structure. Special cases are the conversion of sums, products, the ratio, or the composition of truncated Chebyshev expansions. 12 refs.

37814 (UCRL–101034) **Cray-to-sun prototype.** Requa, J. Lawrence Livermore National Lab., CA (USA). 26 Apr 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8904210–6: Cray user's group conference, Los Angeles, California, USA, 24-28 Apr 1989). Order Number DE89013087/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Cray-to-Sun prototype is an experiment in providing an in-the- office graphics tool using the LINCS architecture developed at LLNL. It represents one of our first attempts at developing a true distributed application utilizing the number crunching power of the Cray and the interactive and graphics capabilities of the Sun workstation. 3 refs., 3 figs.

37815 (UCRL–101237) **Problems and solutions in online documentation systems.** Shuler, J. Lawrence Livermore National Lab., CA (USA). Jun 1989. 5p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-8904210–7: Cray user's group conference, Los Angeles, CA, USA, 24-28 Apr 1989). Order Number DE89014092/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Pogo says "We are surrounded by insurmountable opportunities." DOCUMENT, the online document system at NMFECC, has been continually enhanced and modified in the past 12 years to meet customer needs by analyzing the "insurmountable opportunities" (commonly called problems) that have arisen. We have analyzed where these documentation retrieval problems exist and solved these problems. The greatest challenge was to provide the customer with a stable system using the existing database of documents while adding new features and programs to retrieve information. I will list four of the problems we have encountered, give the solutions and show some indicators of success.

37816 Intelligent robotics and remot systems for the nuclear industry. Wehe, D.K. (Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering); Lee, J.C.; Martin, W.R.; Mann, R.C.; Hamel, W.R.; Tulenko, J. *Nuclear Engineering and Design (Netherlands),* 113(2): 259-267 (Apr 1989). (CONF-870832–: Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry: present and future, Snowbird, Utah, USA, 31 Aug - 2 sep 1987).

The nuclear industry has a recognized need for intelligent, multitask robots to carry out tasks in harsh environments. From 1986 to the present, the number of robotic systems available or under development for use in the nuclear industry has more than doubled. Presently, artificial intelligence (AI) plays a relatively small role in existing robots used in the nuclear industry. Indeed, the lack of intelligence has been labeled the "Achilles heel" of all current robotic technology. However, larger-scale efforts are underway to make the multitask robot more sensitive to its environment, more capable to move and perform useful work, and more fully autonomous via the use of AI. In this paper, we review the terminology, the history, and the factors which are motivating the development of robotics and remove systems; discuss the applications related to the nuclear industry; and, finally, examine the state of the art of the technologies being applied to introduce more autonomous capabilities. Much of this latter work can be classified as within the artificial intelligence framework.

9903 Information Handling

Refer also to citation(s) 35669, 35690, 36047, 36174, 36240, 36257, 36403, 37275

37817 (AD-A-204716/5/XAB) **Analysis of existing advanced data models and their applicability as a model for a multimedia data-base management system. Master's thesis.** Enbody, D.M. Naval Postgraduate School, Monterey, CA (USA). Dec 1988. 83p. Available from NTIS, PC A05/MF A01.

The constant and fast-paced changes that are taking place in computer technology have brought forth a vast array of new applications. It is now possible to store not only standard alpha-numerical data but also graphical, voice, and sound as well. This has opened up enormous possibilities for expanding the use of these data forms. This thesis is directed at exploring those possibilities and several current research projects that are attempting to model a multimedia data-base system. These models are explored in terms of both their strong and weak points. Two possible applications are then looked at in terms of how they could be modeled using each of these three methods.

37818 (INIS-SU–76, pp. 93-95) **Information retrieval system of nuclear fuel account for in-situ on-line control system of NPP with RBMK reactors.** Gorbunov, V.P.; Ivanenko, V.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Physics and technology of atomic reactors. Scientific-technical collection.* Order Number DE89012164/JAW. Available from NTIS (US Sales Only), PC A06/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1.

The structure of information retrieval system for account of nuclear dislocation and movement at NPP, designed for in-situ on-line control system of NPP with RBMK type reactor, is considered. 4 refs.; 2 figs.

37819 (K/DSRD–80) **Approaching distributed database applications using a programmable terminal emulator.** Clinard, J.A.; Robinson, J.J.; Phillips, J.T. Jr.; Johnson, G.L. Oak Ridge Gaseous Diffusion Plant, TN (USA). Jun 1989. 68p. Sponsored by Department of Defense. DOE Contract AC05-84OT21400. Order Number DE89014831/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Two separate approaches were used to develop a prototype for entering data into a remote host computer in an automated manner. In the first approach, revisions were implemented in the IBM PC's terminal emulator VTEK 4.2. These revisions allowed pre-written script files to be processed to the host-based operating system and applications software as if the script file information had been entered on the keyboard. The script processing capability was implemented taking advantage of existing using-defined key capability and the DEC VT100 asynchronous terminal emulation of VTEK communications software. At present the script command and data files must be manually created at the PC using an editor or word processor. The script processing capability works with any host-based operating system or application software that interacts with a DEC VT100 terminal. An example is provided where VTEK script processing is used to automatically interact with a VAX-based Database Management System (DBMS), INGRES, appending PC-resident data records to an INGRES table, creating a default report, aborting to VMS, and disposing of the report ··· all without touching a key. An appendix is provided which discusses the second approach of developing a prototype VT100 emulator specifically designed for data entry to a remote host computer system. This software loads data automatically into a Vax Datatrieve database. It provides an alternative method of prototype development. The challenges for future development are identified and discussed. The use of the programmable terminal emulator for data control in the case of distributed database applications is also discussed. 7 refs.

37820 (ORNL/DSRD–15) **Corporate data base machines: Market analysis for the Joint Staff.** Johnson, M.L.; Phifer, M.S.; Bratten, W.A.; Emrich, M.L. Oak Ridge National Lab., TN (USA). Data Systems Research and Development Program. Jun 1989. 54p. Sponsored by Department of Defense. DOE Contract AC05-84OR21400. Order Number DE89014793/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The Joint Chiefs of Staff initiated a consolidation and expansion of its corporate data base capabilities. This required enhancing and upgrading telecommunications. Network requirements included: migration to an industry standard; and specific software compatibility and application support. A market analysis was conducted to identify machines capable of supporting the new requirements. The results of the study are presented. 31 refs.

37821 (ORNL/FTR–3271) **[Discussions with International Energy Agency's Center for the Analysis and Dissemination of Demonstrated Energy Technologies concerned with database and analysis study series of reports, Sittard, Netherlands, May 22–26, 1989]: Foreign trip report.** Broders, M.A. Oak Ridge National Lab., TN (USA). 2 Jun 1989. 9p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE89014750/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler, representing the United States CADDET National Team, participated in in-depth discussions with the IEA-CADDET concerned with the content, structure, and format of the CADDET database of demonstrated energy technologies and its associated database management system. These discussions resulted in plans being formulated for the further development and improvement of the CADDET database. Further discussions focused attention on the CADDET Analysis Study Series of reports. The first CADDET analysis study in this series, entitled "Small-Scale Cogeneration of Heat and Power," underwent a comprehensive review, and plans were made for its network upgrade prior to final publication.

37822 (SAND–88-3439) **Management Information Database System.** Leishman, N.L. Sandia National Labs., Albuquerque, NM (USA). May 1989. 37p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89014595/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This is a description of a computerized database tool for use by operational management. The Management Information Database System was created to more efficiently maintain the information needed by managers for time and material cost accounting and resource scheduling. Reports produced reflect the current status of assignments and balances of F-orders. 6 figs.

37823 (SSC/ISD–8805) **Proceedings from the fifth information systems technology conference.** Supply and Services Canada, Fredericton, NB (Canada). Information Systems Div. 1988. 106p. (CONF-8805304–: 5. information systems technology conference, Fredericton, Canada, 18-19 May 1988;MICROLOG–88-05840). Available from New Brunswick Legislative Library, Government Documents Section, 766 King Street, Fredericton, NB, Canada E3B 5H1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Current trends and applications of information systems technology were presented at a conference in New Brunswick. Papers were presented on communications networks, information processing systems, optical disc systems and applications, an integrated radio communication system, an automated purchasing system, and the role of computers in assisting workplace synergy. A separate abstract has been prepared for one paper from this conference.

37824 (SSC/ISD–8805, pp. 32) **Information processing at N.B. Power.** Reid, D. (N.B. Power, NB, Canada). Supply and Services Canada, Fredericton, NB (Canada). Information Systems Div. 1988. (CONF-8805304–: 5. information systems technology conference, Fredericton, Canada, 18-19 May 1988;MICROLOG–88-05840). In *Proceedings from the fifth information systems technology conference.* Available from New Brunswick Legislative Library, Government Documents Section, 766 King Street, Fredericton, NB, Canada E3B 5H1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The use of information processing to meet the needs of an electric utility in New Brunswick is described. At the utility, an information systems division has been organized to provide computing capacity and operating support for its various operating divisions. This paper concentrates on the operations of the Distribution Operating Division, which is responsible for electrical service to customers. This division has facilities for identifying and tracking the restoration of electrical service to customers, locating customers

and equipment, servicing customer information requests, work planning and scheduling, engineering analysis, and support for administration and professional staff in common office activities. A number of end user interfaces have been designed to meet specific user requirements, and these interfaces can be changed as necessary without any changes to the communications network.

Corporate Author Index

This index lists the corporate authors responsible for issuing the documents in this publication which are identified primarily by report number. The corporate names are entered in standardized forms as defined in *DOE Energy Data Base: Corporate Author Entries* (DOE/TIC-4585). Each entry under a corporate name includes the document title and citation number. Three items of information may appear in parentheses: (1) an abbreviation to identify the document type, such as a report; (2) the country of publication, also abbreviated; and (3) the language of the document if non-English (R;US;In French). Author affiliations are not listed in this index.

A

Ackco, Inc., Boulder, CO (USA)
[Weatherization assistance program]: Annual report, 14:36379 (R;US)

Aerochem Research Labs., Inc., Princeton, NJ (USA)
Enhanced flame stability and soot radiation using electric fields. Annual report, July 1987-July 1988, 14:35687 (R;US)

Air Force Geophysics Lab., Hanscom AFB, MA (USA)
Precise proper-motion measurement of solar granulation, 14:37421 (R;US)
Snapshots of high-latitude electrodynamics using Viking and DMSP f7 observations, 14:37447 (R;US)
Temporal variations of solar-spectral-line profiles induced by the 5-minute photospheric oscillation, 14:37422 (R;US)

Air Force Weapons Lab., Kirtland AFB, NM (USA)
Proton backscattering in bulk silicon at large angles of incidence. Final report, 14:36657 (R;US)

Aix-Marseille-2 Univ., 13 - Marseille (France). Centre Universitaire de Luminy
Turbulence and abnormal transport in tokamak plasmas, 14:37718 (R;FR;In French)

Alabama Geological Survey, University, AL (USA)
Establishment of an oil and gas database for increased recovery and characterization of oil and gas carbonate reservoir heterogeneiity: Technical progress report, April 19, 1989–June 30, 1989, 14:35600 (R;US)

Alabama Univ., University, AL (USA)
The aquifer chill storage project at the University of Alabama, Tuscaloosa: Progress report for 1985 and 1986, 14:36218 (R;US)

Alabama Univ., University, AL (USA). Dept. of Chemistry
Catalyst accessibility in high voltatile bituminous coal: Quarterly report, 14:35555 (R;US)

Alaska Univ., Fairbanks, AK (USA)
Characterization and utilization of natural gas in Alaska: Final report, 14:35670 (R;US)

Alaska Univ., Fairbanks, AK (USA). Sea Grant Program
Persistent Marine Debris, challenge and response: the Federal perspective, 14:37274 (R;US)

Alberta Energy, Edmonton, AB (Canada)
Alberta's energy and mineral resources, 14:36234 (R;CA)

Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada)
UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2, 14:35689 (R;CA)
UNITAR/UNDP, 4th international conference on heavy crude and tar sand. Vol. 1, 14:35702 (R;CA)

Alberta/Canada Energy Resources Research Fund, Edmonton, AB (Canada)
Alberta Research Council [research reports-1982], 14:35517 (R;CA)
Alberta/Canada Energy Resources Research Fund annual review, 1987-1988, 14:36238 (R;CA;In English and French)

Alliance Technologies Corp., Chapel Hill, NC (USA)
Guidance for the preparation of quality-assurance plans for O_3/CO SIP (State Implementation Plan) emission inventories. Final report, 14:37205 (R;US)

AMAX Research and Development Center, Golden, CO (USA)
Development of an advanced process for drying fine coal in an inclined fluidized bed: Technical progress report for the second quarter, January 19–March 31, 1989, 14:35513 (R;US)

American Gas Association, Inc., New York, NY (USA)
Crack growth behavior and modeling: Topical report, 14:36466 (R;US)

American Inst. of Physics, New York, NY (USA)
Glueballs, hybrids, and exotic hadrons, 14:37490 (B;US)
Physics of particle accelerators: Volume 1, 14:37026 (B;US)
Physics of particle accelerators: Volume 2, 14:37027 (B;US)

Ametek Applied Materials Lab., Harleysville, PA (USA)
Polycrystalline cadmium telluride n-i-p solar cell: Annual subcontract report, 1 June 1987–31 August 1988, 14:35912 (R;US)

AN SSSR, Apatity (USSR). Inst. Khimii i Tekhnologii Redkikh Ehlementov i Mineral'nogo Syr'ya
7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports, 14:37679 (R;SU;In Russian)

AN SSSR, Moscow (USSR)
International solvent extraction conference. Vol. 1. Conference papers, 14:36715 (R;SU;In Russian)

AN SSSR, Moscow (USSR). Fizicheskij Inst.
Experimental and theoretical physics, 14:37420 (R;SU;In Russian)

AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki
Driver and controller for the Odrenok computer, 14:37085 (R;SU;In Russian)

AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij
Intensity of DNA synthesis in immuno-competent organs of animals in early periods after neutron irradiation with different energy values, 14:37377 (R;SU;In Russian)

Analysas Corp., Oak Ridge, TN (USA)
1988 DOE model conference proceedings: Volume 1, 14:35771 (R;US)
1988 DOE model conference proceedings: Volume 2, 14:35772 (R;US)
1988 DOE model conference proceedings: Volume 3, 14:35773 (R;US)
1988 DOE model conference proceedings: Volume 4, 14:35774 (R;US)
1988 DOE model conference proceedings: Volume 5, 14:35775 (R;US)

Arctic Labs. Ltd., Sidney, BC (Canada)
Beaufort Sea ocean dumpsite characterization, 14:35657 (R;CA)

Argonne National Lab., IL (USA)
A central difference type approximation of convection in fluid flow, 14:36977 (R;US)
A method for three-dimensional structural analysis of reinforced concrete containment, 14:36142 (R;US)
Accelerated life evaluation of valve-regulated lead-acid batteries, 14:36221 (R;US)
Bifurcation and pattern formation in combustion, 14:36867 (R;US)
Comparison of analysis and vibration test results for a multiple supported piping system, 14:36143 (R;US)
Containment of organic leachates from leaking underground storage tanks using tailored soils as liners, 14:37216 (R;US)
Contribution of dynamics and erosion for small tube arrays in fluidized beds, 14:35580 (R;US)

Cross-sectional TEM [transmission electron microscopy] studies of Cr films deposited by ion-assisted deposition and physical vapor deposition, 14:36472 (R;US)
Density dependence of the momentum distribution in normal liquid ^{4}He, 14:37639 (R;US)
Development of a polarized deuterium target to measure T_{20} in electron storage rings, 14:37572 (R;US)
Evidence for phonon-mediated coupling in superconducting $Ba_{0.6}K_{0.4}BiO_3$, 14:36615 (R;US)
Field studies for determining the characteristics and dynamics of local circulations, 14:37164 (R;US)
Fifty years of nuclear fission: Nuclear data and measurements series, 14:37560 (R;US)
Grain boundaries in silicon from zero temperature through melting, 14:36476 (R;US)
Implementation of an integrated CERCLA-NEPA environmental process at a FUSRAP site, 14:37226 (R;US)
Implementation of isotope correlation technique for safeguards, 14:35836 (R;US)
Interfacial area measurement methods, 14:36978 (R;US)
Ion-assisted deposition of silver films on ceramics for friction and wear control, 14:36478 (R;US)
Long-term degradation of dilute polyacrylamide solutions in turbulent pipe flow, 14:36422 (R;US)
Methodology for hazardous waste surveys, 14:35779 (R;US)
Nonlinear behavior of a containment building during an earthquake, 14:36085 (R;US)
Pressure drop and heat transfer characteristics of nearly neutrally buoyant particulate slurry for advanced energy transmission fluids, 14:36976 (R;US)
Report on Working Group deliberations: Water quality group, 14:37215 (R;US)
Residual radioactive material guidelines: Methodology and applications, 14:35823 (R;US)
Some remarks on the neutron elastic- and enelastic-scattering cross sections of palladium, 14:37585 (R;US)
Structural and thermodynamic evidence for the survival of Zintl ions through the melting process: The alkali-lead alloys, 14:36662 (R;US)
Superconducting low-velocity linac for the Argonne positive-ion injector, 14:37069 (R;US)
The measurement of Twiss parameters using SFC's, 14:37070 (R;US)
The topological structure of grain boundaries, 14:36477 (R;US)
The US market for high-speed maglev vehicles, 14:36401 (R;US)
Time- and volume-averaged conservation equations for multiphase flow, 14:36979 (R;US)

Argonne National Lab., IL (USA). High Energy Physics Div.
New infinite-dimensional algebras, sine brackets, and SU (∞), 14:37545 (R;US)

Argonne National Lab., IL (USA). Mathematics and Computer Science Div.
Generating alignments of genetic sequences, 14:37285 (R;US)

Arizona State Univ., Tempe, AZ (USA). Dept. of Physics and Astronomy
Scanning tunneling microscopy of an ion-bombarded PbS(001) surface, 14:36656 (R;US)

Arkansas Tech Univ., Russellville, AR (USA). Arkansas Mining and Mineral Resources Research Inst.
Detoxification and generation of useful products from coal combustion wastes: Quarterly technical report, [October–December 1988], 14:35585 (R;US)

Arkansas Univ., Fayetteville, AR (USA). Dept of Geology
Post-Pennsylvanian reactivation along the Washita Valley fault, southern Oklahoma, 14:37411 (R;US)

Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)
Intercomparison of neutron-dosimetry techniques at the AFFRI (Armed Forces Radiobiology Research Institute) TRIGA reactor, 14:37098 (R;US)

Army Construction Engineering Research Lab., Champaign, IL (USA)
Technology selection criteria and methodology for prioritizing energy research and development programs. Final report, 14:36252 (R;US)

Army Engineer Waterways Experiment Station, Vicksburg, MS (USA)
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic): Blue crab, 14:37249 (R;US)

Army Inst. for Water Resources, Fort Belvoir, VA (USA)
National Hydroelectric Power Resources Study. Volume 12, 14:35872 (R;US)

Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD (USA)
Characterization of chemically tritiated microcystin-Lr and its distribution in mouse. Interim report, 14:37328 (R;US)

Asphalt-Labor A.J. Hinrichsen G.m.b.H. und Co., Wahlstedt (Germany, F.R.)
Structural-engineering studies on the use of filter dusts from waste-incinerator flue gas cleaning as an aggregate bitumen in road construction, 14:36420 (R;DE;In German)

Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee
Determination of magnetic field direction in tokamaks from laser-induced Lyman-α fluorescence, 14:37717 (R;FR)
Plugging regime in the pump limiter throat, 14:37719 (R;FR)
Tore Supra first wall description and behaviour during the initial plasma experiments, 14:37760 (R;FR)
Turbulence and abnormal transport in tokamak plasmas, 14:37718 (R;FR;In French)

Atomic Energy Control Board, Ottawa, ON (Canada)
Comparing personal alpha dosimetry with the conventional area monitoring-time weighting methods of exposure estimation: a Canadian assessment, 14:37641 (R;CA)
Computer software configuration management, 14:36098 (R;CA)
Fresh fuel verification feasibility study, 14:36989 (R;CA)

Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.
Advanced instrument development: a case study. Heavy water monitors: the second generation, 14:36026 (R;CA)

Auburn Univ., AL (USA). Dept. of Chemical Engineering
Configurational diffusion of coal macromolecules: Quarterly progress report, March 16–June 15, 1989, 14:35556 (R;US)
Improved performance in co-processing through fundamental and mechanistic studies in hydrogen transfer and catalysis: Quarterly report, December 27, 1988–March 27, 1989, 14:35526 (R;US)

Australian and New Zealand Society of Nuclear Medicine, North Melbourne (Australia)
Guidelines for the practice of radiopharmacy, 14:36857 (R;AU)

Australian Inst. of Nuclear Science and Engineering, Lucas Heights (Australia)
Conference handbook, 14:37347 (R;AU)

Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics
Mass-split dependence of the pre- and post-scission neutron multiplicities for fission of ^{251}Es, 14:37607 (R;AU)
Measurement and statistical model analysis of pre-fission neutron multiplicities, 14:37606 (R;AU)

Australian Nuclear Association, Sutherland (Australia)
Symposium on HIFAR - construction and initial operation, 14:36116 (R;AU)

Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). Nuclear Safety Bureau
First quarterly report of the Nuclear Safety Bureau for the period 19 October 1987 to 18 January 1988, 14:36123 (R;AU)
Second quarterly report of the Nuclear Safety Bureau for the period 19 January 1988 to 18 April 1988, 14:36124 (R;AU)

Ayres Ezer Lau, Inc., Los Angeles, CA (USA)
Assessment of unitary cool storage systems: Final report, 14:36413 (R;US)

B

Babcock and Wilcox Co., Alliance, OH (USA). Research Center
Microstructure and stress corrosion resistance of alloys X-750, 718, and A-286 in LWR environments: Final report, 14:36544 (R;US)

Baker (Michael), Jr., Inc., Beaver, PA (USA)
Utilization potential of coal-combustion by-products: Somerset Power Plant case study. Final report, 14:36418 (R;US)

Baker (Michael), Jr., of New York, Inc., NY (USA)
Cost impact of potential RCRA (Resource Conservation Recovery Act) changes on New York State Utility coal-waste disposal. Final report, 14:35563 (R;US)

Baker/TSA, Inc., Coraopolis, PA (USA)
Design guidelines for a furnace sorbent injection waste management system: Final report, 14:35959 (R;US)

Battelle Columbus Div., OH (USA)
Crack growth behavior and modeling: Topical report, 14:36466 (R;US)
The selective oxidation desulfurization process: bench-scale studies: Final report, 14:35532 (R;US)

Battelle Human Affairs Research Center, Seattle, WA (USA)
Fitness for duty in the nuclear power industry: A review of technical issues, 14:36162 (R;US)

Battelle Pacific Northwest Lab., Richland, WA (USA)
Below regulatory concern owners group: A general review of the IMPACTS-BRC Code: Final Report, 14:35785 (R;US)

BBC Brown Boveri, Inc., Pointe Claire, PQ (Canada)
Software development for a microprocessor based controller for ac-dc-ac diesel-electric freight locomotive power unit control, 14:36443 (R;CA)

BDM Corp., McLean, VA (USA)
Documentation and review of Eastern Gas Shales Technology. Annual report, April 1, 1984-March 31, 1985, 14:35671 (R;US)

Bettis Atomic Power Lab., West Mifflin, PA (USA)
Effluent and environmental monitoring report for calendar year 1988, 14:37204 (R;US)

Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS)
Klein's paradox and the relativistic point interaction, 14:37710 (R;DE)

Black and Veatch/Motor Columbus, Associates, Kansas City, MO (USA)
Hydropower plant modernization guide: Volume 3, Automation: Final report, 14:35875 (R;US)

Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen
Klein's paradox and the relativistic point interaction, 14:37710 (R;DE)

Bonn Univ. (Germany, F.R.). Physikalisches Inst.
On the construction of certain instanton bundles over flat tori, 14:37546 (R;DE)

Boston Univ., MA (USA)
Global density specification in the lower thermosphere. Final report, 15 June 1985-17 June 1988, 14:37448 (R;US)
Ionization equilibrium in dense plasmas, 14:37748 (D;US)

Boston Univ., MA (USA). Dept. of Chemistry
Study of intermediates from transition metal excited-state electron-transfer reactions: Progress report, August 1, 1986–December 31, 1988, 14:36741 (R;US)

BOT Engineering Ltd., Campbellville, ON (Canada)
Fresh fuel verification feasibility study, 14:36989 (R;CA)

Brandeis Univ., Waltham, MA (USA). Dept. of Physics
Research in elementary particle physics: Technical progress report, June 1, 1988–May 31, 1989, 14:37494 (R;US)

British Columbia Hydro and Power Authority, Surrey, BC (Canada)
Water treeing as a function of moisture present in XLPE cable insulation, 14:35968 (R;CA)

British Columbia Hydro, Vancouver, BC (Canada)
Village energy retrofit of electric domestic water heating in a B.C. Hydro diesel generating area, 14:36371 (R;CA)

British Columbia Hydro, Vancouver, BC (Canada). Residential and Commercial Energy Management
Residential domestic water heating advisory computer program. Vol. 2, computer user's guide. Vol. 3, programmer's guide, 14:36372 (R;CA)
Residential domestic water heating advisory computer program. Vol. 1, technical report, 14:36373 (R;CA)

British Inst. for Ornithology, Tring (UK)
Wader migration and distribution in South West estuaries. V. 2. Appendices, 14:35944 (R;GB)
Wader migration and distribution in South West estuaries (in relation to the Severn Barrage). V. 1, 14:35948 (R;GB)

Brookhaven National Lab., Upton, NY (USA)
A study of the use of crosslinked high-density polyethylene for low-level radioactive waste containers, 14:35794 (R;US)
Beam position monitor analysis, 14:37068 (R;US)
BNL workshop on rare K decays and CP violation, August 25-27, 1988, 14:37497 (R;US)
Characterization of painted surfaces in the United States from the perspective of potential damage from acidic deposition, 14:37163 (R;US)
Cognition and order in Langmuir-Blodgett films of a 3-hexadecyl pyrrole and ferrocene-derivatized pyrrole mixed monolayer system, 14:36659 (R;US)
Data base on dose reduction research projects for nuclear power plants: Volume 3, 14:36160 (R;US)
Development of alternate visual examination requirements for dynamic restraints (snubbers), 14:36129 (R;US)
Occupational dose reduction at nuclear power plants: Annotated bibliography of selected readings in radiation protection and ALARA: Volume 4, 14:36159 (R;US)
Recommendations for resolution of public comments on USI [Unresolved Safety Issues] A-40, "Seismic Design Criteria", 14:36165 (R;US)
Small propulsion reactor design based on particle bed reactor concept, 14:36128 (R;US)
Superexchange coupling mechanisms for electron transfer processes, 14:36735 (R;US)
Survey of results from Brookhaven Experiment 802 at the AGS, 14:37596 (R;US)
Synchrotron light source data book, 14:37030 (R;US)
Synchrotron x-ray fluorescence analyses of stratospheric cosmic dust: New results for chondritic and nickel-depleted particles, 14:37425 (R;US)

Brown and Caldwell, Pleasant Hill, CA (USA)
Trace metal removal by iron coprecipitation: Field evaluation: Final report, 14:35960 (R;US)

Brown Univ., Providence, RI (USA)
Data acquisition at D0, 14:37105 (R;US)
Elastic scattering of muon-neutrinos and muon-anti-neutrinos by electrons, 14:37499 (R;US)
Neural networks for event filtering at D∅, 14:37106 (R;US)
Neural networks, D0, and the SSC, 14:37104 (R;US)
Offline computing farms, 14:37028 (R;US)
Progress report for a research program in computational physics, 14:37492 (R;US)

Brown Univ., Providence, RI (USA). Dept. of Physics
A microprocessor farm architecture for high speed data acquisition and analysis, 14:37103 (R;US)
An Outstanding Junior Investigator Award in experimental high energy physics: Progress report, January 1, 1989 to December 31, 1989, 14:37102 (R;US)
Progress report for a research program in theoretical high energy physics, 14:37493 (R;US)
Progress report of a research program in experimental high energy physics: Task B: Progress report, January 1–December 31, 1989, 14:37501 (R;US)
Progress report of a research program in experimental high energy physics, January 1, 1989–December 31, 1989, 14:37500 (R;US)

Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene
Biological indicators for giving proof of exposure to ionizing radiation - lectin coupling to human blood cells possibly a 'biological dosemeter'?, 14:37376 (R;DE;In German)

Bundesministerium des Innern, Bonn (Germany, F.R.)
Structural-engineering studies on the use of filter dusts from waste-incinerator flue gas cleaning as an aggregate bitumen in road construction, 14:36420 (R;DE;In German)

Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)
Improvement of work safety and strain reduction when equipping thin faces through the development and testing of a turning and swinging installation for shield support units. Final report, 14:35596 (R;DE;In German)
Leaching of vitrified high-level-active-waste in a near reality simulated repository system. Final report, 14:35789 (R;DE;In German)
Microbiological investigations on nitrification in waste water treatment plants with fixed sludge beds. Pt. 2. Pilot scale test. Final report, 14:35903 (R;DE;In German)
Process and system for combustion, especially of slow-reacting coal dust, 14:35589 (R;DE;In German)
Waste heat recovery from a sulfuric acid plant, 14:36414 (R;DE;In German)

Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center
Hazards of explosives dusts, 14:37150 (R;US)

Bureau of Mines, Washington, DC (USA)
Potential supply of minerals from the White Mountains National Recreation Area and Part of the North Steese National Conservation Area Alaska. Appendix A- potential mineral supply analysis methodology, 14:36237 (R;US)

C

Caen Univ., 14 (France)
Heavy ions reactions below 100 MeV per nucleon: two contributions to the study of subthreshold pion production, 14:37601 (R;FR;In French)

Calgary Univ., AB (Canada). Faculty of Continuing Education
Challenges and innovations 1989. 6th Annual heavy oil and oil sands technical symposium, 14:35691 (R;CA)

California Dept. of Health Services, Berkeley, CA (USA). Air and Industrial Hygiene Lab.
Southern California Air Quality Study: fall study. Final report, 14:37188 (R;US)

California Inst. of Tech., Pasadena, CA (USA)
Research in nuclear physics at low and intermediate energies, neutrinos and x rays: Final report, May 1980–August 1987, 14:37563 (R;US)
Study of weak solar magnetic fields. Final report, 1 December 1987-30 November 1988, 14:37424 (R;US)

California Univ., Berkeley, CA (USA). Coll. of Engineering
Surface properties of coal and their role in coal beneficiation: Technical progress report, March 15, 1989–June 14, 1989, 14:35557 (R;US)

California Univ., Berkeley, CA (USA). Dept. of Physics
Medium energy meson physics: [Progress report, 1981–1983], 14:37564 (R;US)
Medium energy meson physics: Progress report, January 1, 1986 through December 31, 1986, 14:37565 (R;US)
Medium energy meson research, 14:37506 (R;US)
[Medium energy meson research]: [Progress report], 14:37570 (R;US)

California Univ., Davis, CA (USA). Dept. of Civil Engineering
Centrifuge tests on simulation of the "cookie cutter" mechanism of chimney collapse into underground openings: Final report, 14:37159 (R;US)

California Univ., Los Angeles, CA (USA). Dept. of Chemical Engineering
Continuous thermodynamics and group contribution methods for coal liquids: Final report, October 1, 1986–October 1, 1989, 14:35558 (R;US)

California Univ., Los Angeles, CA (USA). Inst. for Plasma and Fusion Research
Role of alpha particle damping in fast wave current drive and heating, 14:37744 (R;US)

California Univ., Riverside, CA (USA). Dept. of Chemistry
Spectroscopic study of coal structure and reactivity: Quarterly report, January 1, 1989 to March 31, 1989, 14:35552 (R;US)

Cambridge Univ. (UK). Dept. of Engineering
Drum centrifuge modelling of long-term pollutant migration through a soil layer, 14:37222 (R;GB)

Canada Cement Lafarge Ltd., Woodstock, ON (Canada)
Development of air-entrained, high-strength concrete. Normal weight concrete, 14:36660 (R;CA)
Development of air-entrained, high-strength concrete. Lightweight concrete, 14:36661 (R;CA)

Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada)
"Slip effects" in concentrated emulsions, 14:37132 (R;CA)
A preliminary pH analysis of coal slurries from the Sydney Coalfield, N.S., 14:35570 (R;CA)
Bibliography of CANMET publications on coprocessing, 14:35533 (R;CA)
Canadian coal preparation process-control research and development directions, 14:35516 (R;CA)
CANMET Catalogue of publications, 1984/1985, 14:36240 (R;CA;In English and French)
CANMET review 1986-1987, 14:36239 (R;CA;In English and French)
Coal dustiness: characterization and control, 14:35549 (R;CA)
Corrosion inhibition in sour media, 14:36469 (R;CA)
Data compilation report: strata deformation monitoring, No. 3 TBM tunnel, Donkin-Morien mine, N.S., 14:35567 (R;CA)
Energy conservation in the industrial minerals sector. Comminution - Phase 3. Activity 4: monitoring and control of a dry grinding circuit using a particle size analyzer and programmable controllers, 14:36411 (R;CA)
Final report on the comparative combustion properties of raw and washed Prince Mine coal, 14:35588 (R;CA)
Fly ash/cement packing for Lingan Mine: final appraisal and trial proposal, 14:35561 (R;CA)
Measurements of solids concentrations in coal slurries using microwaves, 14:35550 (R;CA)
Methane desorption in coal handling, 14:35548 (R;CA)
Proposal for the development of a computerized guidance system for the Easi-Miner continuous mining machine, 14:35571 (R;CA)
Statistical analysis of collected times between failure and times to repair of Easi-Miner at Obed Mine, 14:35569 (R;CA)
Survey of microprocessor based performance monitoring devices in Canadian surface coal and oil sands mines in 1987, 14:35572 (R;CA)
Technical note on the construction of stoppings or dams in the Sydney coalfield, 14:35574 (R;CA)
The application of rock bolt design methods to a proposed 7 West crosscut, Prince Mine, Sydney Coalfield, N.S., 14:35568 (R;CA)
The selection, development and testing of an integrated truck/shovel management system, 14:35573 (R;CA)
Tube wastage in FBC boilers at Summerside - causes and resolution, 14:37022 (R;CA)
Tube wastage in FBC boilers at Summerside - causes and resolution, 14:35587 (R;CA)

Canadian Forestry Service, Edmonton, AB (Canada). Northern Forest Research Centre
Proceedings of the workshop on aspen pulp, paper and chemicals, 14:35900 (R;CA)

Canadian Fusion Fuels Technology Project, Toronto, ON (Canada)
Canadian contributions to the safety and environmental aspects of fusion, 14:37757 (R;CA)
Conditioning and handling of tritiated wastes at Canadian nuclear power facilities, 14:35770 (R;CA)
Field studies of HT oxidation and dispersion in the environment. I. The 1986 August experiment at Chalk River, 14:37225 (R;CA)
Neutronics analysis for aqueous self-cooled fusion reactor blankets, 14:37756 (R;CA)
Review of synergisms in materials erosion due to multispecies impact, 14:37755 (R;CA)

Canadian Heavy Oil Association (Canada)
Heavy oil. Markets in the 90's. How do they look?, 14:35647 (R;CA)
Optimizing heavy oil production through innovative techniques. Proceedings [of the] fourth quarterly meeting of the Canadian Heavy Oil Association, 14:35618 (R;CA)

Thermal well completions seminar, 14:35722 (R;CA)

Carmel Hospital, Haifa (Israel). Inst. of Endocrinology
Israel EQAS for thyroid related hormones. Final report for the period June 1984 - February 1988, 14:37316 (R;XA)

Carnegie-Mellon Univ., Pittsburgh, PA (USA)
Hyperon production with antiprotons, 14:37503 (R;US)
Lambda-antilambda decay asymmetries and CP violation, 14:37504 (R;US)
Strangeness production with antiprotons at LEAR, 14:37505 (R;US)

Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Physics
Report of the kaon subcommittee of nuclear science advisory committee: Final report, 14:37496 (R;US)
Technical advisory panel for the large acceptance spectrometer: Final report, 14:37108 (R;US)

Cascadia Research Collective, Olympia, WA (USA)
Distribution, abundance and age segregation of bowhead whales in the southeast Beaufort Sea, August-September 1986, 14:35661 (R;CA)

Catholic Univ. of America, Washington, DC (USA)
Advanced instrumentation for local measurement of gas-solid suspension flows: Quarterly technical progress report No. 9/10, November 1, 1988–April 30, 1989, 14:35577 (R;US)

CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)
Neutrons and gamma transport in atmosphere by Tripoli-2 code. Energy deposit and electron current time function, 14:37156 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete
International co-operation in the field of operational safety, 14:36130 (R;FR)
Some aspects of the research and development programmes on the behaviour of containments during severe accidents, 14:36131 (R;FR)
Test emission of uranium hexafluoride in atmosphere. Results interpretation, 14:37198 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale
Measure of back angle cross sections of antiproton-nucleus elastic scattering at 46 and 180 MeV, 14:37577 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie
Prospects of ceramic tritium breeder materials, 14:37754 (R;FR)

Central Electricity Research Labs., Leatherhead (UK)
Determination of boron as boric acid by automatic potentiometric titration, 14:36704 (R;GB)
Proposals for improving interphase drag modelling for the bubbly and slug regimes in RELAP5, 14:36001 (R;GB)

Central Inst. of Physics, Bucharest (Romania)
Advances in Physics, 14:37418 (R;RO;In Rumanian)

Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering
Investigation of relativistic heavy ion interactions with the atomic nuclei, 14:37623 (R;RO;In Romanian)

Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ (Brazil)
Black-hole decay and topological stability in quantum gravity, 14:37426 (R;BR)
Predictions about the decays of the B-mesons, 14:37516 (R;BR)

Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Atividades Espaciais
ECIS - Adaptation to CDC CYBER system, 14:37801 (R;BR;In Portuguese)
Implatation of MC2 computer code, 14:36068 (R;BR;In Portuguese)

Ceskoslovenska Vedeckotechnicka Spolocnost, Bratislava (Czechoslovakia). Dom Techniky
Welding '88. Nondestructive testing of welded joints, 14:36990 (R;CS;In Slovak, Czech)

China Nuclear Information Centre, Beijing, BJ (China)
Determination of trace gold in rocks and minerals by neutron activation analysis, 14:36705 (R;CN;In Chinese)
Investigation of hydrofluorination reactivity on denitrated uranium oxides, 14:35753 (R;CN;In Chinese)
Metallogenetic condition and mineralization characteristics of uranium deposit No.114, 14:35747 (R;CN;In Chinese)
Study on residues and degradation of ^{14}C-phoxim in spring wheat plants and soil, 14:37333 (R;CN;In Chinese)

Chronar Corp., Princeton, NJ (USA)
Research on stable, high-efficiency, large-area, amorphous-silicon-based submodules, Task B: Semiannual subcontract report, 16 March 1988–15 September 1988, 14:35914 (R;US)

City Univ. of New York, NY (USA)
Laser action in chromium-activated forsterite for near-infrared excitation, 14:36959 (R;US)

Colorado State Univ., Fort Collins, CO (USA)
Study of improved methods for predicting chemical equilibria: Composite technical progress report, July 1, 1986–June 30, 1989, 14:36739 (R;US)

Colorado State Univ., Fort Collins, CO (USA). Dept. of Electrical Engineering
A finite-element model for eddy-current nondestructive evaluation: Final report, 14:36086 (R;US)

Colorado State Univ., Fort Collins, CO (USA). Solar Energy Applications Lab.
Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of May and June 1989, 14:35927 (R;US)

Colorado Univ., Boulder, CO (USA)
[Studies of elementary particles and high energy phenomena: [Progress report], 14:37495 (R;US)

Comision Nacional de Energia Atomica, Buenos Aires (Argentina)
Nuclear physics workshop, 14:37561 (R;AR;In Spanish, English, Portuguese)
Summary of activities of the Research Department 1984, 14:37786 (R;AR;In Spanish)

Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Dept. de Fisica
Safety guide of the Tandar accelerator, 14:37640 (R;AR;In Spanish)

Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Gerencia de Proteccion Radiologica y Seguridad
Geological and geophysical investigations at Sierra del Medio massif - Argentine, 14:37403 (R;AR)

Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil)
Use of source term code package in the ELEBRA MX-850 system, 14:36132 (R;BR;In Portuguese)

Commission of the European Communities, Luxembourg (Luxembourg)
Determining the density distribution in a 7 metre coke oven, 14:35535 (R;XE;In German)

Community Resource Services Ltd., St. John's, NF (Canada)
Planning for large-scale construction projects. A socio-economic guide for communities, industry, and government, 14:37282 (R;CA)

Connecticut Univ. Health Center, Farmington, CT (USA). Dept. of Biochemistry
Resistance of bacterial spores to ultraviolet light, 14:37339 (R;US)

Cool Water Coal Gasification Program, Daggett, CA (USA)
Cool Water Coal Gasification Program: Monitoring Review Committee meeting report, Washington, D.C., July 12, 1988, 14:35540 (R;US)

Coors Ceramics Co., Golden, CO (USA)
Compact ceramic heat exchangers. Final report, February 1983-June 1988, 14:35688 (R;US)

Copenhagen Univ. (Denmark)
Pressure-dependent melting curve of natural carnallite, $KMgCl_3.6H_2O$, in a closed system, where evaporation is prevented, 14:37416 (R;DK)

Cornell Univ., Ithaca, NY (USA)
Feasibility of industrial coal conversion at Cornell University. Final report, 14:35542 (R;US)
Novel methods of acceleration. Final report, 30 September 1983-29 September 1988, 14:37067 (R;US)

Cornell Univ., Ithaca, NY (USA). Lab. of Atomic and Solid State Physics
Optical pumping of vibrational overtones in KI:CN-infrared lasers, 14:36957 (R;US)
Resonant charge-exchange studies with hyperthermal-energy ion beams: development of multi-detection capabilities and a data acquisition system. Final report, 15 November 1986-14 May 1988, 14:37460 (R;US)

Council for National Academic Awards, London (UK)
Development of HPLC techniques for the analysis of trace-metal species in the primary coolant of a pressurized-water reactor, 14:36015 (D;GB)

Council for Scientific and Industrial Research, Pretoria (South Africa)
Assessment of the techno-economic potential of Fischer-Tropsch slurry reactors, 14:35543 (R;ZA)
Conversion of methanol over zeolite ZSM-5, 14:35859 (R;ZA)

Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Transport and Road Research
Effects of road condition on the operating costs of buses, 14:36406 (R;ZA)
Effects of road-surface properties on the fuel consumption of trucks and buses, 14:36405 (R;ZA)

Council for Scientific and Industrial Research, Pretoria (South Africa). National Mechanical Engineering Research Inst.
Effect of a diesel blend containing heavy naphtha on the performance and durability of an ADE 236 diesel engine operating with standard-injection timing, 14:36446 (R;ZA)
Effect of a light-diesel blend formulated by BP on the performance and durability of an ADE 314 diesel engine, 14:36445 (R;ZA)
Engine operation on extended diesel fuels, 14:36444 (R;ZA)
NMERI (National Mechanical Engineering Research Institute) experience with alcohol fuels for diesel engines, 14:36451 (R;ZA)
Performance and durability evaluation of a Moteurgaro engine fueled with ethanol, 14:36450 (R;ZA)

Council of Great Lakes Governors, Chicago, IL (USA). Great Lakes Regional Biomass Energy Program
Biomass energy facilities: 1988 Directory of the Great Lakes region, 14:35902 (R;US)

D

Danmarks Geologiske Undersoegelske, Copenhagen (Denmark)
Pressure-dependent melting curve of natural carnallite, $KMgCl_3.6H_2O$, in a closed system, where evaporation is prevented, 14:37416 (R;DK)

Data Resources, Inc., Lexington, MA (USA)
GRI (Gas Research Institute) baseline projection summary. Final report, 14:36262 (R;US)

Data Resources, Inc., Lexington, MA (USA). U.S. Energy Service
DRI (Data Resources Inc.) Energy Model/GRI (Gas Research Institute) Hydrocarbon Model and IFCAM linkage. Final report, September 1983, 14:36265 (R;US)
DRI (Data Resources Inc.) Energy Model/GRI (Gas Research Institute) Hydrocarbon Model and IFCAM linkage. Final report, December 1984, 14:36268 (R;US)
GRI (Gas Research Institute) 1983 baseline projection forecast summary. Final report, 14:36263 (R;US)
GRI (Gas Research Institute) 1983 baseline project forecast methodology and assumptions. Final report, November 1983, 14:36264 (R;US)
GRI (Gas Research Institute) 1984 baseline projection forecast summary. Final report, 14:36266 (R;US)
GRI (Gas Research Institute) 1984 baseline project forecast methodology and assumptions. Final report, July 1985, 14:36267 (R;US)

David Taylor Research Center, Annapolis, MD (USA)
Development of an engineering definition of the extent of J singularity controlled crack growth, 14:36579 (R;US)

Delaware Univ., Newark, DE (USA). Inst. of Energy Conversion
Materials analysis and device optimization of $CuInSe_2$ solar cells: Annual subcontract report, 16 January 1987–15 January 1988, 14:35913 (R;US)
Two-terminal $CuInSe_2$-based cascade cells: Annual subcontract report, 16 January 1987–15 January 1988, 14:35911 (R;US)

Denver Univ., CO (USA). Dept. of Physics
Theoretical modeling of plasma waves in the magnetosphere. Final report, 1 October 1982-30 September 1988, 14:37451 (R;US)

Department of Commerce, Washington, DC (USA). Office of Japanese Technical Literature
Recombinant DNA in Japan: current status and future prospects, 14:37302 (R;US)

Department of Energy, Mines and Resources, Ottawa, ON (Canada)
Waste heat recovery in remote communities. A shared opportunity, 14:35953 (R;CA)
Whitehorse efficient woodheat demonstration, 14:35865 (R;CA)

Department of Energy, Mines and Resources, Ottawa, ON (Canada). Remote Community Demonstration Program
Remote and northern energy-efficient house design catalogue, 14:36380 (R;CA)

Department of Energy, Washington, DC (USA). Assistant Secretary for Fossil Energy
Enhanced oil recovery program plan: FY 1989, 14:35633 (R;US)

Department of External Affairs, Ottawa, ON (Canada)
Canada's new free trade agreement. Energy, 14:36228 (R;CA;In English and French)

Department of National Defence, Ottawa, ON (Canada). Research and Development Branch
Superconductivity. Recent developments and defence applications (U), 14:36666 (R;CA)

Department of the Army, Washington, DC (USA)
Evaluation criteria guide for water-pollution prevention, control, and abatement programs. Technical manual, 14:37281 (R;US)

Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)
Investigation about the usefulness of Landsat 5 thematic mapper data for mapping forest disease, 14:37160 (R;DE;In German)

Deutscher Wetterdienst, Hohenspeissenberg (Germany, F.R.). Meteorologisches Observatorium
Ozone measurements near the ground and in the atmosphere in the first half-year 1988, 14:37170 (R;DE;In German)

Dravo Lime Co., Pittsburgh, PA (USA)
5-MW Toronto HALT [Hydrate Addition at Low Temperature] pilot plant testing: Test results: Part 1-A, 14:35958 (R;US)

Duesseldorf Univ. (Germany, F.R.)
Construction of an expression vector for the gram-negative bacterium Zymomonas mobilis, 14:37315 (R;DE;In German)

Dynamics Research Corp., Andover, MA (USA)
Developing software to use parallel processing effectively. Final report, June-December 1987, 14:37797 (R;US)

E

Economic Systems Analysis, Inc., Oak Ridge, TN (USA)
Technology 'Master List' data base management system. User's manual. Topical report, 14:35669 (R;US)

Ecosometrics, Inc., Bethesda, MD (USA)
Planning techniques for intercity transportation services. Final report, 14:36407 (R;US)

EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations
The occurrence and status of candidate species listed by the US Fish and Wildlife Service on Naval Petroleum Reserve No. 1, Kern County, California, 14:37207 (R;US)

EG and G Energy Measurements, Inc., Las Vegas, NV (USA)
In search of more output: Two strain gage bridge circuits revisited, 14:37135 (R;US)

EG and G Idaho, Inc., Idaho Falls, ID (USA)
A review of recent developments in pipe damping allowable values for United States nuclear plants, 14:35990 (R;US)
Aging degradation of BWR feedwater and main steam lines, 14:35989 (R;US)
Results of the initial phase of the INEL/USNRC large bore hydraulic snubber reliability evaluation program, 14:36144 (R;US)

EG and G Mound Applied Technologies, Miamisburg, OH (USA)
An Auger sputter profiling study of nitrogen and oxygen ion implantation in two titanium alloys, 14:37688 (R;US)
An efficient palladium isotope chromatograph (EPIC) for hydrogen, 14:36727 (R;US)
Computer aided process planning conceptual design and functional specification, 14:36879 (R;US)
Investigation of ambient and high temperature aging of PETN [pentaerythritol tetranitrate] by laser induced fluorescence and ultraviolet absorption spectroscopies, 14:37152 (R;US)
The effect of ultra-high vacuum on thermal ionization processes, 14:37140 (R;US)
The effective utilization of differential scanning calorimetry (DSC) to assess molded parts, 14:36678 (R;US)

Electric Power Research Inst., Palo Alto, CA (USA)
A comparison of steam-injected gas turbine and combined-cycle power plants: Technology assessment: Final report, 14:35955 (R;US)
A finite-element model for eddy-current nondestructive evaluation: Final report, 14:36086 (R;US)
Assessment of unitary cool storage systems: Final report, 14:36413 (R;US)
Below regulatory concern owners group: A general review of the IMPACTS-BRC Code: Final Report, 14:35785 (R;US)
Below Regulatory Concern Owners Group: Assessment of the IMPACTS-BRC code: Final report, 14:35786 (R;US)
Design considerations for on-site spent-fuel transfer systems: Final report, 14:35767 (R;US)
Design guidelines for a furnace sorbent injection waste management system: Final report, 14:35959 (R;US)
Electromagnetic transients program (EMTP): Volume 3, Workbook III: Final report, 14:35954 (R;US)
Feature-enhanced-imaging field trials: Peach Bottom Unit 3: Interim report, Phase 2, 14:35992 (R;US)
Guidelines for quality records in electronic media for nuclear facilities (NCIG-10): Final report, 14:36047 (R;US)
Hydropower plant modernization guide: Volume 3, Automation: Final report, 14:35875 (R;US)
Information and automation technology: Serving electric utility customers in the 1990s: Conference proceedings, 14:36257 (R;US)
Microstructure and stress corrosion resistance of alloys X-750, 718, and A-286 in LWR environments: Final report, 14:36544 (R;US)
Modeling hydrogen water chemistry for BWR applications: Final report, 14:35991 (R;US)
Surveillance of instrumentation channels at nuclear power plants: Volume 2, An approach to classifying problems and solutions: Final report, 14:36095 (R;US)
The plant expert system (PLEXSYS) development environment: System description and user's manual, version 2: Final report, 14:36007 (R;US)
The selective oxidation desulfurization process: bench-scale studies: Final report, 14:35532 (R;US)
Trace metal removal by iron coprecipitation: Field evaluation: Final report, 14:35960 (R;US)
Vibration monitoring of main coolant pumps: Guideline and reference data: Final report, 14:36096 (R;US)

Electrowatt Engineering Services Ltd., Horsham (UK)
1987 United Kingdom radioactive waste inventory, 14:35781 (R;GB)

Electrowatt Engineering Services Ltd., Zurich (Switzerland)
Dutch nuclear programme. Role of the Dutch industry, 14:36063 (R;NL)

Eltron Research, Inc., Aurora, IL (USA)
Electrochemical conversion of C(1) molecules. Final report, February 1, 1986-December 31, 1988, 14:35861 (R;US)

Energy and Environmental Research Corp., Irvine, CA (USA)
Development of a vortex-containment combustor for coal-combustion systems. Report for January 1980-December 1983 (Final), 14:35591 (R;US)

Energy Resources Conservation Board, Calgary, AB (Canada)
Applications by Phillips Petroleum Resources, Ltd. for permits to construct pipelines to transport sour gas and fuel gas in the salter field, 14:35683 (R;CA)

Energy Technology Support Unit, Harwell (UK)
River Loughor tidal power scheme. A feasibility study report, 14:35949 (R;GB)

Environment Canada, Burlington, ON (Canada). Wastewater Technology Centre
Creating fuel oil from sewage sludge, 14:35857 (R;CA;In English and French)

Environment Canada, Ottawa, ON (Canada)
Perspectives on land modelling. Workshop proceedings, 14:36235 (R;CA)

Environment Canada, Ottawa, ON (Canada). Environmental Protection Service
Removal of radium-226 from uranium mining effluents. Final report of a joint government-industry program, 14:35787 (R;CA)
Reporting for the domestic substances list, 14:36232 (R;CA;In French)

Environment Canada, Ottawa, ON (Canada). Inland Waters Directorate
A large-sample extractor for determining organic contaminants in the Great Lakes, 14:37257 (R;CA)
An application of SPANS technology to toxic contaminant monitoring in the Atlantic region, 14:37219 (R;CA)
Proceedings of the technology transfer workshop [for] northern water quality monitoring, 14:37256 (R;CA)
Quebec surface water data, 1987, 14:35873 (R;CA)

Environment Canada, Saskatoon, SK (Canada). National Hydrology Research Inst.
NOGAP C-11A. Sediment regime of lakes in the Mackenzie Delta, 14:37234 (R;CA)

Environmental Protection Agency, Duluth, MN (USA). Environmental Research Lab.
AQUIRE: Aquatic Toxicity Information Retrieval data base. Data file, 14:37275 (R;US)

Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility
Radiological survey of San Diego Bay, 14:37279 (R;US)
Radiological surveys of Naval Facilities on Puget Sound, 14:37278 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Research and Exposure Assessment Lab.
National Performance Audit Program; ambient air audits of analytical proficiency, 1987, 14:37189 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards
National Air Audit System FY 1986-1987 national report. Final report, 14:37192 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Radiation Programs
Radiological surveys of Naval Facilities on Puget Sound, 14:37278 (R;US)

Environnement Canada, Ottawa, ON (Canada). Conservation et Protection
National incinerator testing and evaluation program. Environmental characterization of mass burning incinerator technology at Quebec City. Summary report, 14:37168 (R;CA)
National incinerator testing and evaluation program. Environmental characterization of mass burning incinerator technology at Quebec City. Summary report, 14:37169 (R;CA;In French)
Recommendations on a preferred site for the ocean disposal of bulky inert materials in Beaufort Sea waters adjacent to the Northwest Territories, 14:35658 (R;CA)
Selection of an area in the Canadian Beaufort Sea for disposal of inert bulky materials such as scrap metal. An assessment of options, 14:35659 (R;CA)

ESL Environmental Sciences Ltd., Vancouver, BC (Canada)
Distribution, abundance and age segregation of bowhead whales in the southeast Beaufort Sea, August-September 1986, 14:35661 (R;CA)

F

Federal Aviation Administration, Washington, DC (USA). Office of Airport Planning and Programming
Eligibility of noise-abatement proposals for grants-in-aid under the airport improvement program, 14:37398 (R;US)

Fermi National Accelerator Lab., Batavia, IL (USA)
Automatic steering corrections to minimize injection oscillations in the Fermilab Antiproton Source rings, 14:37074 (R;US)
Gabor lens focusing of a negative ion beam, 14:37051 (R;US)
Machines for lattice gauge theory, 14:37549 (R;US)
Macroscopic constraints on string unification, 14:37548 (R;US)
The cosmological constant problem, 14:37438 (R;US)
Windows on the axion, 14:37517 (R;US)

Fish and Wildlife Service, Washington, DC (USA)
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic): Blue crab, 14:37249 (R;US)

Flow Research Co., South Kent, WA (USA)
Phase relationships in high-temperature ceramics. Phase 1. Final report, 14:36610 (R;US)

Forest Service, Madison, WI (USA). Forest Products Lab.
Thermal properties of wood and wood panel products for use in buildings, 14:36378 (R;US)

Forintek Canada Corp., Ottawa, ON (Canada)
Steam pretreatment of wood in relation to enzymatic hydrolysis. Final report, 14:35904 (R;CA)

Forintek Canada Corp., Vancouver, BC (Canada). Western Forest Products Lab.
A field evaluation of four wood pole groundline preservative formulations using western Canadian wood species, 14:36674 (R;CA)

Foster Wheeler USA Corp., Clinton, NJ (USA)
Engineering support services for the DOE/GRI coal gasification research program: Technical progress report for the period June 25–September 30, 1988, 14:35524 (R;US)

Frankfurt Univ. (Germany, F.R.). Fachbereich 13 Physik
Radiation damages in silicon induced by highly energetic electrons and protons, 14:36676 (R;DE;In German)

Fraunhofer-Institut fuer Werkstoffmechanik, Freiburg im Breisgau (Germany, F.R.)
Recent advances in modelling creep crack growth. Proceedings, 14:36545 (R;DE)

Freiburg Univ. (Germany, F.R.). Fakultaet fuer Physik
Strangeness production with antiprotons at LEAR, 14:37505 (R;US)

G

Gas Research Inst., Chicago, IL (USA)
GRI (Gas Research Institute) catalog of technical reports, 14:35668 (R;US)
Transport and Storage (3.3) Subprogram for Gas Research Institute: status report - 1988 projects, 14:35684 (R;US)

General Accounting Office, Washington, DC (USA). National Security and International Affairs Div.
Nuclear power safety, 14:36145 (R;US)

General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.
Energy regulation, 14:35894 (R;US)
Indoor radon, 14:37199 (R;US)
Nuclear health and safety, 14:35831 (R;US)
Nuclear regulation, 14:36146 (R;US)

General Atomics Co., San Diego, CA (USA)
DIII-D power supply fault system, 14:37761 (R;US)

General Atomics, San Diego, CA (USA)
GACAP: A new computer code for analysis of symmetric and nonsymmetric cask cross sections, 14:36871 (R;US)

General Coherent Technology, Inc., Richardson, TX (USA)
Gamma-ray-laser pump diagnostic. Final report, 14:37582 (R;US)

General Dynamics Corp., San Diego, CA (USA). Convair Div.
Some aspects of Starfish, 14:37154 (R;US)

General Electric Co., Fairfield, CT (USA)
Fabrication, pre-irradiation characterization and irradiation history of GE rods, for The Super-Ramp Project: The Studsvik Super-Ramp Project, 14:35998 (R;SE)

General Electric Co., Lenox, MA (USA). High Voltage Transmission Research Center
Study of electric field and ion effects of HVDC [high voltage direct current] transmission lines: Characterization of the electrical environment beyond the corridor: Final report, 14:35969 (R;US)

General Electric Co., San Jose, CA (USA). Nuclear Energy Div.
Modeling hydrogen water chemistry for BWR applications: Final report, 14:35991 (R;US)

General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center
Detection and characterization of novel metal-binding proteins: Final report, 14:37324 (R;US)
Electrode-induced beta battery degradation. Final report, 14:36222 (R;US)

Geo-Centers, Inc., Newton Upper Falls, MA (USA)
Jet-fuel deoxygenation. Interim report, March 1987-July 1988, 14:35642 (R;US)

Geological Survey, Boise, ID (USA). Water Resources Div.
The hydrothermal system in central Twin Falls County, Idaho, 14:35938 (R;US)

Geological Survey, Denver, CO (USA)
Index of granitic rock masses in the state of Nevada: A compilation of data on 205 areas of exposed granitic rock masses in Nevada, 14:37407 (R;US)

Georgia Inst. of Tech., Atlanta, GA (USA). Fusion Research Center
Review of effects of NBI [neutral beam injection] and rotation on plasma transport in tokamaks, 14:37720 (R;US)

Georgia State Univ., Atlanta, GA (USA). Dept. of Physics
Multiple ionization of xenon by proton impact, 14:37462 (R;US)

Georgia Univ., Athens, GA (USA). Georgia Cooperative Fish and Wildlife Research Unit
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic): Blue crab, 14:37249 (R;US)

Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)
ATHLET - an advanced system code for the analysis of thermohydraulic processes, 14:36152 (R;DE;In German)
Large-scale experiments and their significance for development and verification of thermal hydraulics computer codes, 14:36151 (R;DE;In German)
Nuclear plant analyser, a tool for evaluating actions of accident management, 14:36153 (R;DE;In German)
Perspectives of expert systems for nuclear reactor safety, 14:36150 (R;DE;In German)
Reactor safety research results and perspectives, 14:36149 (R;DE;In German)

Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)
Discovery and confirmation of fission, 14:37602 (R;DE)
Plastic Ball experiments, 14:37110 (R;DE)
Search for resonant Bhabha scattering at MeV energies, 14:37507 (R;DE)

Gewerkschaft Sophia-Jacoba, Hueckelhoven (Germany, F.R.)
Process and system for combustion, especially of slow-reacting coal dust, 14:35589 (R;DE;In German)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii
Support system for loop device operator. Analysis of technological processes, 14:36097 (R;SU;In Russian)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike
Design and construction. Scientific-technical collection, 14:36872 (R;SU;In Russian)
Nuclear reactor physics and technology. Scientific-technical collection, 14:36072 (R;SU;In Russian)

Physical experiment technique. Scientific-technical collection, 14:37419 (R;SU;In Russian)
Physics and technology of atomic reactors. Scientific-technical collection, 14:36065 (R;SU;In Russian)
Thermonuclear synthesis. Scientific-technical collection, 14:37712 (R;SU;In Russian)
Welding in nuclear technology. Scientific-technical collection, 14:36559 (R;SU;In Russian)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij
Correction of field distribution in an H-wave weakly irregular accelerating structure, 14:37054 (R;SU;In Russian)
High-energy physics. Panorama of programs. Description of the problem situation, 14:37518 (R;SU;In Russian)
Quasistatic model of H-wave accelerating structures, 14:37053 (R;SU;In Russian)
Some mathematical aspects of creation of the control system for a physical installation. Analytical review, 14:37076 (R;SU;In Russian)

Grambling State Univ., LA (USA). Dept. of Chemistry
Correlation of stability/rheology relationship with coal properties and chemical additives: Quarterly progress report, September 15, 1988–December 15, 1988, 14:35554 (R;US)

Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)
Compressional effects in heavy ion collisions: spinodal decomposition and thermal energy saturation, 14:37608 (R;FR)
Explosions in Landau Vlasov dynamics, 14:37762 (R;FR)
Heavy ions beam axial injection tudy in a compact cyclotron, 14:37075 (R;FR;In French)
Heavy ions reactions below 100 MeV per nucleon: two contributions to the study of subthreshold pion production, 14:37601 (R;FR;In French)
Multiplicity of neutrons from violent heavy-ion collisions: ^{40}Ar + Th and U from 10 to 77 MeV/u, 14:37603 (R;DE)
Theoretical and numerical study of cyclotron in space charge conditions, 14:37052 (R;FR;In French)

Grenoble-1 Univ., 38 (France)
Measure of back angle cross sections of antiproton-nucleus elastic scattering at 48 and 180 MeV, 14:37577 (R;FR;In French)

Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires
Decay of new mass-separated neutron-deficient La and Ce isotopes, 14:37581 (R;FR)
Low-spin states in ^{122}Cs, 14:37589 (R;FR)
Thermal neutron detection with a lithium-6 loaded liquid scintillator, 14:37114 (R;FR)

H

Hacettepe Univ., Ankara (Turkey)
Methods for studying effects of high-energy irradiation on the mechanical and electric properties of polymers, 14:36655 (R;TR)

Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.)
Multiplicity of neutrons from violent heavy-ion collisions: ^{40}Ar + Th and U from 10 to 77 MeV/u, 14:37603 (R;DE)

Hanford Engineering Development Lab., Richland, WA (USA)
Submerged gravel scrubber demonstration as a passive air cleaner for containment venting and purging with sodium aerosols—CSTF tests AC7–AC10, 14:36028 (R;US)
Submerged gravel scrubber demonstration tests: Performance of a large-scale unit, 14:36029 (R;US)

Hardy BBT Ltd., Edmonton, AB (Canada)
Handling and disposal of waste drilling fluids from on-land sumps in the Northwest Territories and Yukon, 14:35660 (R;CA)

Harvard Univ., Boston, MA (USA). Harvard Air Cleaning Lab.
Proceedings of the 20th DOE/NRC nuclear air cleaning conference: Sessions 1–5, 14:37200 (R;US)
Proceedings of the 20th DOE/NRC nuclear air cleaning conference: Sessions 6–15, 14:37201 (R;US)

Harvard Univ., Cambridge, MA (USA). Lyman Lab. of Physics
Couplings in the heterotic superconformal three generation model, 14:37529 (R;DK)

Hawaii Univ., Honolulu, HI (USA). Dept. of Meteorology
Indoor spatial monitoring of combustion-generated pollutants (TSP, CO, and BAP) by Indian cookstoves, 14:37162 (R;US)

Health Care Financing Administration, Baltimore, MD (USA). Bureau of Program Operations
Radiology PRICER 2.0 subroutine installation guide, Volume 1 and Volume 2, 14:37322 (R;US)
Radiology PRICER 2.0 subroutines for RADMAIN and RADPRICE. Software, 14:37321 (R;US)

Hebrew Univ., Jerusalem (Israel). Dept. of Inorganic and Analytical Chemistry
Transparent glass ceramics doped by chromium(iii) and chromium(iii) and neodymium(iii) as new materials for lasers and luminescent solar concentrators. Final report, 1 October 1985-30 June 1988, 14:35928 (R;IL)

Heidelberg Univ. (Germany, F.R.). Physikalisch-Chemisches Inst.
Leaching of vitrified high-level-active-waste in a near reality simulated repository system. Final report, 14:35789 (R;DE;In German)

Hessisches Ministerium fuer Wirtschaft und Technik, Wiesbaden (Germany, F.R.)
Sewage gas utilisation for cogeneration. Conference documentation, 14:36423 (R;DE;In German)

Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics
Gauge invariant cosmological perturbations with cold dark matter, 14:37530 (R;JP)
Gravitational lensing and finite beam-width effect on cosmic microwave anisotropies, 14:37442 (R;JP)
On a quantized scalar field in some Kantowski-Sachs' universes, 14:37444 (R;JP)
Perturbation of c=1 conformal field theory and quantum sine-Gordon theory, 14:37557 (R;JP)
Relations between Virasoro algebra and Krichever-Novikov algebra on a torus, 14:37556 (R;JP)
Stochastic dynamics of an inflationary model and initial distribution of universes, 14:37443 (R;JP)
Wormhole instanton solution in the Einstein-Yang-Mills system, 14:37445 (R;JP)

Holditch (S.A.) and Associates, Inc., Bryan, TX (USA)
Reservoir Engineering and Treatment Design Technology. Annual report, December 1987-November 1988, 14:35676 (R;US)

Houston Univ., TX (USA)
Beam-beam interaction and pacman effects in the SSC with random nonlinear multipoles, 14:37050 (R;US)
Compact linacs for positron emission tomography, 14:37035 (R;US)

Human Technology, Inc., McLean, VA (USA)
Hazard Communication Project: reference manual, 14:37330 (R;US)

Hydro-Quebec, Montreal (Canada)
Hydro-Quebec development plan, 1988-1990. 1997 outlook. Abridged version, 14:36224 (R;CA;In French)
Hydro-Quebec development plan, 1988-1990. 1997 outlook. Full-length version, 14:36225 (R;CA;In French)

HydroGeoLogic, Inc., Herndon, VA (USA)
VAM2D–Variably saturated analysis model in two dimensions: Version 5.0 with hysteresis and chained decay transport: Documentation and user's guide, 14:35793 (R;US)

Hydronetics, Inc., Chicago, IL (USA)
Laser based machine for die and prototype manufacturing: Final report, February 10, 1987–August 9, 1988, 14:36870 (R;US)

I

ICF-Lewin Energy, Fairfax, VA (USA)
Site selection for GRI (Gas Research Institute) cooperative tight-gas field research. Volume 1: screening of candidate tight gas formations. Topical report, May-July 1988, 14:35672 (R;US)

Idaho Dept. of Water Resources, Boise, ID (USA)
The hydrothermal system in central Twin Falls County, Idaho, 14:35938 (R;US)

Idaho National Engineering Lab., Idaho Falls, ID (USA)
Plant life extension program for the Advanced Test Reactor, 14:36114 (R;US)

Idaho Univ., Moscow, ID (USA). Center for Applied Thermodynamic Studies
Study of data distributions and functions for the development of thermodynamic equations of state. Annual report, June 1987-May 1988, 14:35686 (R;US)
Idaho Univ., Moscow, ID (USA). Dept. of Chemistry
Improved acid electrolytes for fuel cells. Final report, July 1985-January 1989, 14:36364 (R;US)
Idaho Univ., Moscow, ID (USA). Dept. of Metallurgical and Mining Engineering
Electrochemistry of thiobacillus ferrooxidans reactions with pyrite: Technical progress report, January 15–April 15, 1989, 14:35528 (R;US)
Illinois Univ., Chicago, IL (USA). Lab. for Atomic Molecular and Radiation Physics
Studies of collisional and nonlinear radiative processes for development of coherent uv and xuv sources. Final report, 30 September 1985-29 September 1988, 14:37463 (R;US)
Illinois Univ., Urbana, IL (USA). Dept. of Chemical Engineering
Supercritical fluid thermodynamics for coal processing: Quarterly progress report, September 15, 1988–December 31, 1988, 14:35529 (R;US)
Illinois Univ., Urbana, IL (USA). Dept. of Computer Science
Asynchronous integration of ordinary differential equations on multiprocessors, 14:37802 (R;US)
Indiana Univ., Bloomington, IN (USA)
High resolution electron energy loss studies of surface vibrations: Progress report, July 1, 1988–June 20, 1989, 14:36481 (R;US)
Indugas, Inc., Toledo, OH (USA)
Gas-based iron making: feasibility study. Final report, April 1985-December 1986, 14:36419 (R;US)
Industriele Raad voor Energie- en Milieutechnologie (IREM), The Hague (Netherlands)
Dutch nuclear programme. Role of the Dutch industry, 14:36063 (R;NL)
Institut de Recherche d'Hydro-Quebec, Varennes, PQ (Canada)
Abrasion-erosion resistance of various repairing mortars, 14:36679 (R;CA)
Cyclic loading for distribution cables in duct banks, Vol. 4, 14:35970 (R;CA)
Determination of the nature and content of antioxidant and antioxidant synergist in PE and XLPE used in cables, 14:36728 (R;CA)
Effect of oil viscosity on transformer loading capability at ambient temperatures below 0^0C, 14:35972 (R;CA)
Power line fault probabilities, 14:35971 (R;CA)
Institut Forestier National de Petawawa, Chalk River, ON (Canada)
Theory and methodology of single tree volume estimation, 14:35907 (R;CA;In English and French)
Institut fuer Umweltanalytik und Biotechnologie G.m.b.H., Pforzheim (Germany, F.R.)
Microbiological investigations on nitrification in waste water treatment plants with fixed sludge beds. Pt. 2. Pilot scale test. Final report, 14:35903 (R;DE;In German)
Institut Jozef Stefan, Ljubljana (Yugoslavia)
Calculation analysis of TRIGA MARK II reactor core composed of two types of fuel elements. Final report for the period 1 August 1984 - 31 July 1986, 14:36115 (R;XA)
Institut Laue-Langevin, 38 - Grenoble (France)
1987 ILL experimental reports and theory college activities, 14:37417 (R;FR)
Institut National des Sciences et Techniques Nucleaires (INSTN), Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)
Characterization by positron annihilation of vacancies in gallium arsenide, 14:36675 (R;FR;In French)
Institute of Gas Technology, Chicago, IL (USA)
Coal-test program in a pressurized, fluidized-bed ash-agglomerating process development unit. Volume 2. Data analysis. Final report, November 15, 1984-August 31, 1987, 14:35544 (R;US)
Institute of Occupational Medicine, Edinburgh (UK)
Further studies of respiratory health of wool textile workers. Final report, October 1986-July 1988, 14:37191 (R;GB)
Release of dispersed asbestos fibres from soils, 14:37190 (R;GB)
Institute of Technology Assessment, Springfield, IL (USA)
Guide to land treatment of municipal waste water in Illinois, 14:36433 (R;US)
Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil)
Experimental study of the phenomena of turbulent flow in the narrow gaps between subchannels of rod bundles, 14:36033 (R;DE;In German)
Intellicorp, Mountain View, CA (USA)
The plant expert system (PLEXSYS) development environment: System description and user's manual, version 2: Final report, 14:36007 (R;US)
International Atomic Energy Agency, Vienna (Austria)
$^{230}Th/^{234}U$ dating of the quaternary spring travertines in the Arava Rift Valley of Israel and paleoclimatic implications. Final report for the period 15 December 1986 - 15 December 1987, 14:37405 (R;XA)
Agreement of 27 September 1988 between the International Atomic Energy Agency and the Government of India for the application of safeguards in connection with the supply of a nuclear power station from the Union of Soviet Socialist Republics, 14:35837 (R;XA)
Calculation analysis of TRIGA MARK II reactor core composed of two types of fuel elements. Final report for the period 1 August 1984 - 31 July 1986, 14:36115 (R;XA)
Implementation of computer programmes for fitting of positron annihilation spectra on "personal computers". Final report for the period 1 May 1986 - 14 June 1988, 14:37468 (R;XA)
Israel EQAS for thyroid related hormones. Final report for the period June 1984 - February 1988, 14:37316 (R;XA)
Reviewing surveillance activities in nuclear power plants. Supplementary guidance and reference material for IAEA Operational Safety Review Teams (OSARTs), 14:36147 (R;XA)
Statement of the Islamic Republic of Iran, 14:36453 (R;XA)
Statement of the official spokesman of the Iraqi Ministry of Foreign Affairs, 14:36452 (R;XA)
Tenth working group meeting of representatives of RCA Member States. Report, 14:37788 (R;XA)
International Centre for Theoretical Physics, Trieste (Italy)
Compactifications of the eleven-dimensional supermembrane, 14:37700 (R;XA)
Enlarged superfluid model of atomic nucleus, 14:37609 (R;XA)
Local structure of a 2-codimensional conformally flat submanifold in an Euclidean space R^{n+2}, 14:37699 (R;XA)
Paleomagnetic study of Shanwang formation, Shandong Province, China, 14:37409 (R;XA)
Seismic zoning in India, 14:37408 (R;XA)
Iowa State Univ. of Science and Technology, Ames, IA (USA)
Optical properties of metals and alloys: Au, Ag, FeRh, $AuAl_2$, and $PtAl_2$, 14:36604 (D;US)
Theoretical investigations of phonon anomalies in fcc La and W(001), 14:36603 (D;US)
Istituto Nazionale di Fisica Nucleare, Milan (Italy)
Generalised exciton model theories for the description of pre-equilibrium angular distributions, 14:37620 (R;IT)
Itasca Consulting Group, Inc., Minneapolis, MN (USA)
Analysis of alternative waste isolation concepts, 14:35795 (R;US)

J

Japan Atomic Energy Research Inst., Tokyo (Japan)
Analysis of the CSNI/GREST core concrete interaction chemical thermodynamic benchmark exercise using the MPEC2 computer code, 14:35993 (R;JP)
Annual report of the Osaka Laboratory for Radiation Chemistry, Japan Atomic Energy Research Institute, (no. 20). April 1, 1986 - March 31, 1987, 14:36855 (R;JP)
Break location effects on PWR small break LOCA phenomena. Inadequate core cooling in lower plenum break test at LSTF, 14:36156 (R;JP)
Critical heat flux (CHF) characteristics of high conversion pressurized water reactor with double flat core, 14:36010 (R;JP;In Japanese)

Fission products plate-out analysis code in the HTGR: PLAIN, 14:36021 (R;JP;In Japanese)
Graphite structural design code for the High Temperature Engineering Test Reactor, 14:36023 (R;JP;In Japanese)
Measurement of the current distribution in JT-60 plasma by He beam, 14:37733 (R;JP;In Japanese)
Study on the optimization with shielding design of marine reactor, 14:36038 (R;JP;In Japanese)
Study on the reaction between SiC and Pd, (2), 14:36022 (R;JP;In Japanese)

Jednota Ceskoslovenskych Matematiku a Fyziku, Prague (Czechoslovakia)
Ninth conference of Czechoslovak physicists. Part 1, 2, 14:37678 (R;CS;In Czech, Slovak)

Jersey Central Power and Light Co., Morristown, NJ (USA)
A comparison of steam-injected gas turbine and combined-cycle power plants: Technology assessment: Final report, 14:35955 (R;US)

Joint Inst. for Nuclear Research, Dubna (USSR)
4. International symposium on selected topics in statistical mechanics, 14:37702 (R;SU;In Russian)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation
Classification of integrable two-dimensional models of relativistic field theory by means of computer, 14:37552 (R;SU;In Russian)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy
Automodel properties of baryon clusters in interactions of p-, d-, He-, C- and π^--particles with carbon nuclei within 4-40 GeV/c per nucleon momentum interval, 14:37632 (R;SU;In Russian)
Program for calculating parameters of atomic beam of polarized particle source and jet polarized targets on 'Pravets-16', 14:37086 (R;SU;In Russian)
Study on total disintegration of lead nuclei with magnesium-24 nuclei at 4.5 A GeV/c, 14:37598 (R;SU;In Russian)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics
Analysis of dynamic characteristics of ^{235}U fission with resonance neutrons on the basis of data on fission fragment charge and mass fragmentation, 14:37634 (R;SU;In Russian)
Intensive two-quantum cascades and fragmentation of quasiparticle states in some deformed nuclei, 14:37633 (R;SU;In Russian)
Results of experimental investigation of injector part of the LIU-30 accelerator, 14:37087 (R;SU;In Russian)
Study on fragment charge and mass fragmentation in ^{235}U fission with resonance neutrons, 14:37604 (R;SU;In Russian)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems
Hardware and software complex for cyclotron beam dynamics simulation, 14:37062 (R;SU;In Russian)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions
Ionization chamber-detecting setup of Vasilisa installation for the study of characteristics of total fusion reaction product decay, 14:37115 (R;SU;In Russian)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics
Adiabatic representation of scattering problem in three-body quantum system, 14:37705 (R;SU;In Russian)
Dipole octupole correlations in a boson model and evidence for their existence in nuclei, 14:37631 (R;SU)
Klein's paradox and the relativistic point interaction, 14:37710 (R;DE)

Jones (J.A.) Applied Research Co., Charlotte, NC (USA)
Feature-enhanced-imaging field trials: Peach Bottom Unit 3: Interim report, Phase 2, 14:35992 (R;US)

K

Kahl Associates, Sacramento, CA (USA)
Lawrence Livermore National Laboratories Environmental Protection Department 1988 California legislative highlights, 14:36233 (R;US)

Kaiser Engineers, Inc., Pittsburgh, PA (USA)
Testing of pyrite flotation techniques on selected Ohio coals: Final report, 14:35512 (R;US)
[Advanced froth flotation techniques]: Quarterly technical progress report No. 1, September 1, 1988–November 30, 1988, 14:35511 (R;US)

Kansas State Univ., Manhattan, KS (USA)
Fundamental magnetic studies of iron-rare-earth-metalloid alloys: Technical performance report, 14:36483 (R;US)

Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau
Experimental study of the phenomena of turbulent flow in the narrow gaps between subchannels of rod bundles, 14:36033 (R;DE;In German)

Kearney (A.T.), Inc., Alexandria, VA (USA)
Trial-Burn Observation Guide. Final report, 14:36438 (R;US)

Kentucky Univ., Lexington, KY (USA). Dept. of Chemistry
Laser spectroscopy and dynamics of combustion intermediates: Three year progress report, 1 June 1986–31 May 1989, 14:36868 (R;US)

Kentucky Univ., Lexington, KY (USA). Dept. of Materials Science and Engineering
Structural and surface characterization of dispersed metal catalysts: Final report, September 1, 1986–December 31, 1988, 14:36482 (R;US)

Kentucky Univ., Lexington, KY (USA). Research Foundation
Feasibility study of utilization of coal-mine refuse; Estill County, Kentucky, 14:35562 (R;US)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Forschungsgruppe Wirtschaft, Energie, Investitionen
Non-proliferation regime, vertical proliferation and the interests of the Federal Republic of Germany, 14:36247 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Atmosphaerische Chemie
Studies as to the measurement and the chemistry of formaldehyde and acetaldehyde in the lower troposphere, 14:37171 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Biotechnologie
Construction of an expression vector for the gram-negative bacterium Zymomonas mobilis, 14:37315 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung
On the accident behaviour of the HTR-100. A risk-oriented analysis, 14:36157 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung
Investigation and test results of the PNP steam reformer test bundle in the EVA-II-plant, 14:36024 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe
Fracture mechanics investigations for components of the steam cycle in an HTR electricity producing plant, 14:36571 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Technik und Gesellschaft
Non-proliferation regime, vertical proliferation and the interests of the Federal Republic of Germany, 14:36247 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Energieforschung
Waste heat recovery from a sulfuric acid plant, 14:36414 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung fuer Chemische Analysen
Activation analysis of air particulate matter, 14:36720 (R;DE)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik
Experimental study of the phenomena of turbulent flow in the narrow gaps between subchannels of rod bundles, 14:36033 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Festkoerperphysik
Ion beam modification and analysis of thin $YBa_2Cu_3O_7$ films, 14:36677 (R;DE)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente
Gas-liquid flow in dividing Tee-junctions with a horizontal inlet and different branch orientations and diameters, 14:36981 (R;DE)
TEGENA: Detailed experimental investigations of temperature and velocity distributions in rod bundle geometries with turbulent sodium flow, 14:36032 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter
TEGENA: Detailed experimental investigations of temperature and velocity distributions in rod bundle geometries with turbulent sodium flow, 14:36032 (R;DE;In German)

Koeln Univ. (Germany, F.R.)
Studies as to the measurement and the chemistry of formaldehyde and acetaldehyde in the lower troposphere, 14:37171 (R;DE;In German)

Kraftwerk Union A.G., Erlangen (Germany, F.R.). Hauptbereich Brennstoffkreislauf
Base irradiation history and interim inspection of the KWU/CE test fuel rods of rod groups PK 1 and PK 2: The Studsvik Super-Ramp Project, 14:36013 (R;SE)
Base irradiation history and interim inspection of the BWR test fuel rods of rod group BK7: The Studsvik Super-Ramp Project, 14:35997 (R;SE)
Test fuel rod fabrication and pre-irradiation characterization report, rod groups PK1, PK2 and BK7: Studsvik Super-Ramp Project, 14:35996 (R;SE)

Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.
Report on the instrumented Charpy impact test for metallic materials, 14:36992 (R;JP;In Japanese)

L

Lawrence Berkeley Lab., CA (USA)
Canonical integration and analysis of periodic maps using nonstandard analysis and life methods, 14:37709 (R;US)
Channelling and related effects in electron microscopy: The current status, 14:36726 (R;US)
Comparison of conventional mixing and displacement air conditioning and ventilating systems in US commercial buildings, 14:36386 (R;US)
Cosmic relics from the big bang, 14:37440 (R;US)
Electrochemically adsorbed Pb on Ag (111) studied with grazing-incidence x-ray scattering, 14:36854 (R;US)
Energy use in buildings: The US experience and lessons for China, 14:36384 (R;US)
Excitation and multiple dissociation of projectiles at intermediate energy, 14:37599 (R;US)
Fuel cell technology in the United States, 14:36362 (R;US)
General properties of an asymmetric B-factory lattice, 14:37064 (R;US)
High-power, high-efficiency FELs, 14:36965 (R;US)
History of the application of the generalized Lewis acid-base theory to metals, 14:36575 (R;US)
Journal of Glenn T. Seaborg (Chairman, US Atomic Energy Commission, 1961 through 1971), July 1, 1961–December 31, 1961, 14:36249 (R;US)
Journal of Glenn T. Seaborg, Chairman of the US Atomic Energy Commission, 1961–1971: Volume 1, February 1, 1961–June 30, 1961, 14:36248 (R;US)
Least-cost planning in the utility sector: Progress and challenges, 14:36338 (R;US)
Observations on the mechanisms of fatigue in eutectic Pb-Sn solder joints, 14:36574 (R;US)
Present and future searches for the Higgs Boson with the MEVVA high current metal ion source, 14:37527 (R;US)
Proceedings of the Chinese-American symposium on energy markets and the future of energy demand, 14:36258 (R;US)
Prospects for the FEL [Free Electron Laser], 14:36964 (R;US)
Separation of low molecular weight alcohols from dilute aqueous solutions by reversible chemical complexation, 14:36725 (R;US)
Spectral measurements of the cosmic microwave background, 14:37441 (R;US)
Tritium labeling by thermally generated tritons, 14:36845 (R;US)
Vertical gradient freeze GaAs: Growth and electrical properties, 14:36576 (R;US)
WINDOW 3.1: A PC program for analyzing window thermal performance: Program description and tutorial, 14:36385 (R;US)

Lawrence Livermore National Lab., CA (USA)
A MACSYMA package for the generation and manipulation of Chebyshev series, 14:37813 (R;US)
A probabilistic method for estimating system susceptibility to HPM, 14:37131 (R;US)
A proposal of more expedient methods of testing machine tools, 14:36998 (R;US)
A review of the development of a program to generate inspection programs for the OGP [Optical Gaging Products] optical CMM [Coordinate Measuring Machine], 14:37147 (R;US)
A structural evaluation of the Shippingport reactor pressure vessel for transport impact conditions, 14:36014 (R;US)
An architecture for real-time control and data acquisition at LLNL's high explosives application facility (HEAF), 14:37153 (R;US)
Backgrounder contribution No. 18: Climate scenarios for the first UC/DOE workshop, 14:37161 (R;US)
Chemistry and Materials Science research report: Weapons-Supporting Research and Departmental Institutional Research and Development: First half FY1989, 14:37158 (R;US)
Chiral organic crystals for high power frequency conversion, 14:37781 (R;US)
Cray-to-sun prototype, 14:37814 (R;US)
DYNA3D user's manual: (Nonlinear dynamic analysis of structures in three dimensions): Revision 5, 14:36893 (R;US)
Dynamics of colloidal dispersions via lattice-gas models of an incompressible fluid, 14:37488 (R;US)
Effects of trace gases on global atmospheric chemical and physical processes, 14:37195 (R;US)
Energy and Technology Review, 14:37303 (R;US)
Ethics and nuclear weapons research, 14:36460 (R;US)
Evaluating CFC [chlorofluorocarbon] alternatives from the atmospheric viewpoint: Revision 1, 14:37196 (R;US)
Fission barriers for r-process nuclei and implications for astrophysics, 14:37636 (R;US)
High-temperature optical-fiber pH sensor: Final report, 14:36848 (R;US)
Kinetics of the gas phase tritium oxidation reaction, 14:36849 (R;US)
Lawrence Livermore National Laboratory oil shale quarterly report, January–March 1989, 14:35731 (R;US)
Linear theory of uncompensated thermal blooming in turbulence, 14:37486 (R;US)
Modeling of subsurface geology in Medicine Lake, California, 14:35939 (R;US)
Modeling of the proposed ATA fast correction coils, 14:37046 (R;US)
Multi-segment Nd:Glass disk amplifiers, 14:37782 (R;US)
Nonlinear hydrodynamical innstabilities, transitions, and coherent features: Final report, 14:37487 (R;US)
PFMS [Precision Flexible Manufacturing System] tool characterization study at Lawrence Livermore National Laboratory, 14:36587 (R;US)
Problems and solutions in online documentation systems, 14:37815 (R;US)
Program listings for GRPANL: A suite of computer programs for analyzing complex Ge and alpha-particle detector spectra: Volume 3, 14:37120 (R;US)
Stemming temperature changes during emplacement: Experimental results and analysis, 14:36982 (R;US)
Tapering FEL amplifiers in wiggler period and field, 14:36966 (R;US)
Technique for fission measurements of highly active and weak cross-section actinides, 14:37605 (R;US)
The analysis of lead slump effects in shipping casks for radioactive materials, 14:36894 (R;US)
The equation of state of perfluorododecane to 48 GPa, 14:36847 (R;US)
Vacuum insulator failure measurements and improvement, 14:37019 (R;US)
Vulnerability inducing technologies: An initial appreciation, 14:36455 (R;US)

Lehigh Univ., Bethlehem, PA (USA)
Infrared study of carbon deposits on catalysts, 14:36736 (R;US)

Levy (S.), Inc., Campbell, CA (USA)
Design considerations for on-site spent-fuel transfer systems: Final report, 14:35767 (R;US)

LGL Ltd. Environmental Research Associates, King City, ON (Canada)
Beaufort Sea ocean dumpsite characterization, 14:35657 (R;CA)

Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV (USA)
Use of industrial-hygiene samplers for soil-gas measurement, 14:37221 (R;US)

Lockheed Missiles and Space Co., Inc., Palo Alto, CA (USA). Research and Development Div.
Study of fine-scale solar dynamics. Final report, 6 September 1985-31 October 1988, 14:37423 (R;US)

Los Alamos National Lab., NM (USA)
^{17}O NMR study of $YBa_2Cu_3O_{7-\delta}$, 14:36641 (R;US)
A battery-powered flux compression generator system, 14:37008 (R;US)
A discrete fracture model for a hot dry rock geothermal reservoir, 14:35941 (R;US)
A simultaneous helical generator, 14:37011 (R;US)
An economic prefeasibility study of geothermal energy development at Platonares, Honduras, 14:35940 (R;US)
An improved hibachi support structure for electron-beam diode foils, 14:36963 (R;US)
Anomalous temperature dependence of Cu NMR line width and magnetization in $YBa_2Cu_3O_{7-\delta}$, 14:36642 (R;US)
Application of process monitoring to verify facility design, 14:35839 (R;US)
Applications of the computer codes FLUX2D and PHI3D for the electromagnetic analysis of compressed magnetic field generators and power flow channels, 14:37480 (R;US)
Atomic oxygen-MoS_2 chemical interactions, 14:36844 (R;US)
Barium potassium bismuth oxide: Synthesis and physical properties, 14:36639 (R;US)
Calculational evaluation of plasma flow switches for the Los Alamos Foil Implosion Project, 14:37003 (R;US)
Caviton dynamics in strong Langmuir turbulence, 14:37457 (R;US)
Central American resource studies, 14:36236 (R;US)
Challenges to the nonproliferation regime into the 21st Century: Conference summary, 14:36454 (R;US)
Competing interactions and complexity in condensed matter, 14:37687 (R;US)
Computer simulations of explosive volcanic eruptions, 14:37410 (R;US)
Cost of a normalconducting linac structure, 14:37041 (R;US)
Cost projection for a superconducting linac structure, 14:37042 (R;US)
Design of an explosive pulsed power system for driving 16-MA plasma flow switch experiments, 14:37734 (R;US)
Detection of photon bursts from single 200 eV Mg ions: Progress in photon burst mass spectrometry, 14:37139 (R;US)
Development of neutron multiplicity counters for safeguards assay, 14:35790 (R;US)
Disk generator with nearly shockless accelerated driver plate, 14:37010 (R;US)
Economics of selected energy applications of peat in Panama and Costa Rica, 14:35595 (R;US)
Exploding metallic foils and fuses: A computational modeling update, 14:37006 (R;US)
Explosively formed fuse opening switches for use in flux-compression generator circuits, 14:37007 (R;US)
Foil implosion studies on PEGASUS, 14:37686 (R;US)
HEU [highly enriched uranium] drum monitor manual (for confirmatory measurements), 14:35768 (R;US)
High voltage power condition systems powered by flux compression generators, 14:37005 (R;US)
High-brightness electron injectors: A review, 14:37088 (R;US)
High-performance, high-current fuses for flux compression generator driven inductive store power conditioning applications, 14:37013 (R;US)
High-voltage pulsed transformer development, 14:37009 (R;US)
Influence of a biased beam dump on H^- beam neutralization measurements with a four-grid energy analyzer, 14:37089 (R;US)
Instability of concave conductor surfaces at high magnetic pressure, 14:37481 (R;US)
$K^0_L \rightarrow \mu\mu$ polarization: Future prospects, 14:37512 (R;US)
KrF lasers for inertial confinement fusion, 14:37770 (R;US)
LAVA [Los Alamos Vulnerability and Risk Assessment] and classical risk analysis, 14:35838 (R;US)
Lessons learned in the DOE Computer Security Enhancement Review Program, 14:37805 (R;US)
Los Alamos Center for Computer Security formal computer security model, 14:37807 (R;US)
Magnetopause structure and dynamics: Issues for GEM [geospace environment modeling], 14:37456 (R;US)
Modeling of non-structural contribution to the pattern, 14:37685 (R;US)
Neutrino mass experiments, 14:37511 (R;US)
Nuclear relaxation rates at copper and oxygen sites in $YBa_2Cu_3O_7$, 14:36640 (R;US)
Numerical simulation of plasma opening switches, 14:37806 (R;US)
Numerical simulation of the simultaneous detonation of two identical, fully contained explosions, 14:37151 (R;US)
Offensive versus defensive tradeoffs in the European theater, 14:36456 (R;US)
Parallel electric fields in a simulation of magnetotail reconnection and plasmoid evolution, 14:37455 (R;US)
Particle production results from HELIOS, 14:37595 (R;US)
Performance of the 10kV, 100-kA pulsed-power modules for the FRX-C magnetic compression experiment, 14:37771 (R;US)
Physics with ETA mesons, 14:37510 (R;US)
Plasma flow switch characterization for the Los Alamos Foil Implosion Project, 14:37012 (R;US)
Polycrystal plasticity as applied to the problem of in-plane anisotropy in rolled cubic metals, 14:36572 (R;US)
Possible roles of tactical nuclear weapons in maritime conflict, 14:36459 (R;US)
Precision electroweak physics with neutrinos at Los Alamos, 14:37526 (R;US)
Proceedings of the small period wiggler designs workshop: Summary, 14:36962 (R;US)
Proton linear accelerators: A theoretical and historical introduction, 14:37040 (R;US)
Prototype testing for a hybrid gas-gun/railgun device, 14:36878 (R;US)
Quantum mechanical stabilization of Minkowski signature wormholes, 14:37708 (R;US)
Radiative collapse of a Bennett-relaxed z-pinch, 14:37736 (R;US)
Reliability estimates for large satellite memories in low earth orbits, 14:37002 (R;US)
Remote-controlled NDA [nondestructive assay] systems for feed and product storage at an automated MOX [mixed oxide] facility, 14:35757 (R;US)
Reservoir water loss modeling and measurements at Fenton Hill, New Mexico, 14:35942 (R;US)
Safety testing program for the Galileo mission radioisotope thermoelectric generator, 14:36158 (R;US)
SiC-$MoSi_2$ composites, 14:36638 (R;US)
Significant improvement in IR surface-temperature measurements, 14:37137 (R;US)
Static load cycle testing of a low-aspect-ratio six-inch wall TRG-type structure TRG-4-6 (1.0, 0.25), 14:36091 (R;US)
Study of atomic physics and population inversions with plasma focus, 14:37473 (R;US)
Summary of Linac Group discussions, 14:37043 (R;US)
The high density z-pinch II experiment, 14:37735 (R;US)
The Los Alamos Fourier-transform spectrometer: Applications to molecular spectroscopy, 14:37138 (R;US)
The Mark 101 flux compression generator: Development progress, 14:37090 (R;US)
The Mark IX generator, 14:37004 (R;US)
The response of single crystal and polycrystal nickel to quasistatic and shock deformation, 14:36573 (R;US)
The stability of the High-Density Z-Pinch, 14:37737 (R;US)

Unattended mode operation of specialized NDA [nondestructive assay] systems, 14:35756 (R;US)
Unbunched beam electron-proton instability in the PSR and advanced hadron facilities, 14:37063 (R;US)
Unique applications of tamper indicating devices, 14:35840 (R;US)

Los Alamos National Lab., NM (USA). Center for National Security Studies
Postwar US conventional military policy: Lessons and implications for the seventh era and beyond, 14:36457 (R;US)

Los Alamos Nuclear Corp., NM (USA)
Study of coupling in Starfish, 14:37155 (R;US)

Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Petroleum Engineering
Cyclic CO_2 injection for light oil recovery: Performance of a cost shared field test in Louisiana: Second quarterly report, 21 February–21 May 1989, 14:35632 (R;US)

Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Physics and Astronomy
Measurement of solar proton-proton fusion neutrinos with a Soviet-American gallium experiment: Technical progress report, 14:37583 (R;US)

Lowell Univ., MA (USA). Center for Atmospheric Research
Electron-density profiles and plasma-drift measurements with digital ionosondes. Technical report, July 1987-June 1988, 14:37452 (R;US)

Lund Inst. of Tech. (Sweden). Dept. of Mathematical Physics
On the feeding and spectroscopy of superdeformed states, 14:37635 (R;SE)

Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire
AMPHORA detector, 14:37116 (R;FR)
Periodic system of chemical elements: old and new developments, 14:36703 (R;FR)

M

Mainz Univ. (Germany, F.R.). Inst. fuer Kernchemie
Discovery and confirmation of fission, 14:37602 (R;DE)

Management and Technical Consultants, Inc., Columbia, MD (USA)
Development of a pulsed coal combustor fired with CWM [coal-water mixture]: Phase 3, Final report, 14:35582 (R;US)

Manitoba Dept. of Environment and Workplace Safety and Health, Winnipeg, MB (Canada). Water Standards and Studies Section
Canada-Manitoba agreement on the study and monitoring of mercury pollution in the diversion system of the Churchill River. Summary report, 14:35896 (R;CA;In French)
Water chemistry/water discharge relationships within the Churchill River diversion and Lake Winnipeg regulation region, Manitoba, Canada, 14:35895 (R;CA)

Manitoba Dept. of Natural Resources, Winnipeg, MB (Canada). Fisheries Branch
Summary of phytoplankton data for the Nelson River and Rat-Burntwood lakes, 1987, 14:37235 (R;CA)

Manitoba Public Utilities Board, Winnipeg, MB (Canada)
Application by Greater Winnipeg Gas Company and ICG Utilities (Manitoba) Ltd. for an order or orders approving rates for the sale of natural gas from November 1, 1988 to October 31, 1990, flowing from new gas supply contracts, 14:35677 (R;CA)
Manitoba Hydro application for an order requesting a general rate review and approval of certain rate adjustments effective April 1, 1989, 14:36339 (R;CA)

Manitoba Univ., Winnipeg, MB (Canada)
Final report of the Commission of Inquiry into Gasoline Pricing in the province of Manitoba, 1987, 14:35655 (R;CA)

Marine Mammal Commission, Washington, DC (USA)
Preliminary assessment of habitat protection needs for West Indian manatees on the east coast of Florida and Georgia. Final report, 14:37284 (R;US)

Martin Marietta Energy Systems, Inc., Oak Ridge, TN (USA)
1988 DOE model conference proceedings: Volume 2, 14:35772 (R;US)
1988 DOE model conference proceedings: Volume 3, 14:35773 (R;US)
1988 DOE model conference proceedings: Volume 5, 14:35775 (R;US)

Martin Marietta Energy Systems, Inc., Piketon, OH (USA)
Long-range health and safety management plan, fiscal years 1989–1995, 14:35842 (R;US)

Martin Marietta Energy Systems, Inc., Portsmouth, OH (USA). Quality and Technical Services Div.
A review of the Model 5A uranium hexafluoride cylinder, 14:35769 (R;US)

Martin Marietta Labs., Baltimore, MD (USA)
Evolution of the chemistry of passive films of sputter-deposited, supersaturated Al alloys. Annual report, 1 July 1987-30 November 1988, 14:36461 (R;US)

Maryland Univ., College Park, MD (USA). Dept. of Computer Science
Parallel problem-solving system, PRISM (Parallel Inference System). Final report, November 1986-February 1988, 14:37796 (R;US)

Maryland Univ., College Park, MD (USA). Lab. for Plasma Research
Free electron laser with small period wiggler and sheet electron beam: A study of the feasibility of operation at 300 GHz with 1 MW CW output power, 14:36961 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA)
Secondary atomization of coal-water fuels for gas turbine applications: Final report, 14:35581 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Center for Space Research
Path-integral formulation of ion heating, 14:37450 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Chemistry
Chemistry of bimetallic linked cyclopentadienyl complexes: Progress report, 1 December 1986–30 November 1989, 14:36738 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Electrical Engineering and Computer Science
Thin-film optics for signal-processing applications. Final report, 1 September 1986-31 May 1988, 14:36999 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Nuclear Engineering
Magnetohydrodynamic clump instability, 14:37713 (R;US)

Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab.
Effect of noble gases on the properties of ion-beam-sputtered niobium films, 14:36465 (R;US)
Single-frequency microchip Nd lasers, 14:36960 (R;US)

Massachusetts Univ., Amherst, MA (USA). Water Resources Research Center
Fiscal year 1987 program report (Massachusetts Water Resources Research Center). Annual report, 14:37280 (R;US)

Materials Engineering Associates, Inc., Lanham, MD (USA)
Post-irradiation fracture toughness characterization of four lab-melt plates: Revision 1, 14:36578 (R;US)

Materials Research Labs., Ascot Vale (Australia)
Corrosion of high-density sintered tungsten alloys. Part 1. Immersion testing, 14:36463 (R;AU)
Corrosion of high-density sintered tungsten alloys. Part 2. Accelerated corrosion testing, 14:36464 (R;AU)
Introduction to lithium batteries. General document, 14:36220 (R;AU)

Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik
Development of new type of silicon detector with internal amplification, 14:37117 (R;DE;In German)

McGill Univ., Montreal, PQ (Canada). Dept. of Mechanical Engineering
A summary of hydrogen-air detonation experiments, 14:36161 (R;US)

McMaster Univ., Hamilton, ON (Canada). Inst. for Energy Studies
General economic stimulation and energy indicators for capital investment initiatives in various transportation modes, 14:36229 (R;CA)

Mechanical Technology, Inc., Latham, NY (USA)
Heat exchanger development for steam-injected Brayton cycle: Final report for period September 30, 1984 to April 30, 1988, 14:36577 (R;US)

Meharry Medical Coll., Nashville (USA). Dept. of Biochemistry
Respiratory enzymes of Thiobacillus ferrooxidans: Progress report, March 1988–July 1989, 14:37325 (R;US)

Membrane Technology and Research, Inc., Menlo Park, CA (USA)
Development of a membrane SO_x/NO_x treatment system: Final report, 28 April 1987–28 April 1988, 14:35957 (R;US)

Ministerio de Ciencia e Tecnologia, Brasilia, DF (Brazil)
Advanced ceramics in Brazil: actual stage and perspectives, 14:36635 (R;BR;In Portuguese)

Ministerium fuer Wissenschaft und Kunst des Landes Niedersachsen, Hannover (Germany, F.R.)
Formation and development of deposits in salt strata. Final report, 14:35598 (R;DE;In German)

Ministerstvo Vysshego I Srednego Spetsial'nogo Obrazovaniya SSSR, Moscow (USSR)
Isotopes in catalysis. Issue 147. Proceedings of the Moscow Chemical Technological Institute, 14:36702 (R;SU;In Russian)

Minnesota Univ., Minneapolis, MN (USA). Corrosion Research Center
Investigation of polymeric solid-electrolyte cells, carried out during a nominal three-year period, focused on the rechargeable lithium battery. Final report, 15 July 1985-30 October 1988, 14:36219 (R;US)

Mississippi State Univ., Mississippi State, MS (USA). MHD Energy Center
Diagnostic development and support of MHD test facilities: Progress report, July–September 1987, 14:36345 (R;US)

Missouri Univ., Columbia, MO (USA). School of Forestry, Fisheries and Wildlife
Explorations of mechanisms regulating ectomycorrhizal colonization of boron-fertilized pine: Quarterly report, April 1,1989–June 30, 1989, 14:35901 (R;US)

Missouri Univ., Rolla, MO (USA). Rock Mechanics and Explosives Research Center
Coal disintegration by high-pressure waterjet: Final report, 14:35514 (R;US)

Mitsubishi Electric Corp., Tokyo (Japan)
Research and development on a 3-kW-class Stirling engine, 14:36390 (R;JP)

Montreal Univ., PQ (Canada). Centre de Recherche sur les Transports
A planning model for electrical power distribution grids, 14:35973 (R;CA;In French)

Moskovskij Khimiko-Tekhnologicheskij Inst., Moscow (USSR)
Isotopes in catalysis. Issue 147. Proceedings of the Moscow Chemical Technological Institute, 14:36702 (R;SU;In Russian)

Muenchen Univ. (Germany, F.R.). Fakultaet fuer Chemie und Pharmazie
Development of radioimmunological methods to determine the constituents of nicotiana plants and cell cultures, 14:37299 (R;DE;In German)

Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik
Development of new type of silicon detector with internal amplification, 14:37117 (R;DE;In German)

N

Nagoya Univ. (Japan). Inst. of Plasma Physics
Energy eigenvalues of helium-like atoms in dense plasmas, 14:37731 (R;JP)
Experimental data processing techniques by a personal computer, 14:37804 (R;JP;In Japanese)
Homeostasis in plasma confinement at beta close to unity, 14:37728 (R;JP)
Long-time correlation for the chaotic orbit in the two-wave Hamiltonian, 14:37729 (R;JP)
Measurement of radiation power from the JIPP T-IIU tokamak plasma, 14:37732 (R;JP)

National Academy of Sciences - National Academy of Engineering, Washington, DC (USA). Super Collider Site Evaluation Committee
Siting the superconducting super collider, 14:37033 (R;US)

National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center
NASA Lewis Stirling engine computer code evaluation, 14:36448 (R;US)

National Bureau of Standards, Washington, DC (USA). Surface Science Div.
Structure and reactivity of chemisorbed species and reaction intermediates: Progress report, December 1, 1984–November 30, 1985, 14:36742 (R;US)

National Energy Board, Ottawa, ON (Canada)
Canadian energy supply and demand, 1987-2005, 14:36259 (R;CA)
Canadian energy supply and demand, 1987-2005, 14:36260 (R;CA;In French)
Reasons for descisions-TransCanada Pipelines Ltd. Requests pertaining to the installation and to the approval of the method of devising rights and of the connected questions about rates, 14:35682 (R;CA;In French)

National Heart, Lung, and Blood Inst., Bethesda, MD (USA)
Identification and characterization of reaction steps and enzyme catalysts involved in the conversion of acetate and methyl groups to methane. Final report, October 1984-October 1987, 14:35860 (R;US)

National Inst. for Coal Research, Pretoria (South Africa)
Oil phase in selective agglomeration: a structural approach, 14:35515 (R;ZA)
Report on the combustion of screened duff coal in a chain-grate stoker-fired boiler, 14:35590 (R;ZA)

National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)
Health-hazard evaluation determination report No. 75-109, 110, 112, 114-274, Fairbanks Weighing Division, Colt Industries, St. Johnsbury, Vermont, 14:37182 (R;US)
Health-hazard evaluation determination report No. 75-178-295, New York Telephone and Telegraph Company, 770 Broadway, New York, New York, 14:37183 (R;US)
Health-hazard evaluation determination report No. 75-151-259, Winchester Hospital, Winchester, Massachusetts, 14:37184 (R;US)
Health-hazard evaluation determination report No. 74-78-297, Amax Speciality Metals, Parkersburg, West Virginia, 14:37185 (R;US)
Health-hazard evaluation determination report No. 73-185-256, Electromotive-Division, GMC (Plant 2), Chicago, Illinois, 14:37186 (R;US)
Preliminary survey report: control technology support for sensor, Unimin Corporation, Dividing Creek Sand Plant, Millville, New Jersey, August 16, 1988, 14:37179 (R;US)

National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Physical Sciences and Engineering
Testing of hair dryers for asbestos emissions, 14:37180 (R;US)

National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)
Thermodynamic equilibria in the biphenyl/hydrogen system (The power and limitations of group additivity estimations): Topical report, 14:35664 (R;US)

National Inst. of Radiation Protection, Stockholm (Sweden)
Short summary of International workshop on principles for disposal of radioactive and other hazardous wastes, Stockholm 7-10 june 1988, 14:35791 (R;SE)

National Mechanical Engineering Research Inst., Pretoria (South Africa). Geomechanics Div.
Roofbolt support in board and pillar workings, 14:35576 (R;ZA)

National Mechanical Engineering Research Inst., Pretoria (South Africa). Heat Mechanics Div.
Potential of electric heat pumps for heating water in South Africa, 14:36391 (R;ZA)

National Physical Research Lab., Pretoria (South Africa). Atmospheric Sciences Div.
Statistics on smoke and sulfur dioxide pollution in South Africa. Special report, 14:37187 (R;ZA)

National Regulatory Research Inst., Columbus, OH (USA)
User's manual: GCOST: A gas cost-of-service program: Version 1.0, 14:36432 (R;US)

National Research Council of Canada, Boucherville, PQ (Canada). Industrial Materials Research Inst.
Abrasion-erosion resistance of various repairing mortars, 14:36679 (R;CA)
Determination of the nature and content of antioxidant and antioxidant synergist in PE and XLPE used in cables, 14:36728 (R;CA)
Laboratory investigation on the evaluation of crude oil concentration by spectroscopic methods, 14:35665 (R;CA)
Localized electrons in tetragonal $YBa_2Cu_{2.93}O_{6.38}$, 14:36644 (R;CA)
Microstructural investigation of $RBa_2Cu_3O_7$-δ (R=Y, Gd, Nd), 14:36645 (R;CA)
Performance of sulfation and nitration plates used to monitor atmospheric pollutant deposition in a real environment, 14:37172 (R;CA)
Plasma spraying of WO/sub3/. Structure characterization of the coating, 14:36643 (R;CA)
Solid-state interaction between nickel and $YBa_2Cu_3O_x$, 14:36646 (R;CA)

National Research Council, Washington, DC (USA). Committee on Chemical Engineering Frontiers-Research Needs and Opportunities
Frontiers in chemical engineering: Research needs and opportunities, 14:36244 (R;US)

National Technical Information Service, Springfield, VA (USA)
Atmospheric modeling of air pollution. September 1984-March 1988 (Citations from the NTIS data base). Report for September 1984-March 1988, 14:37194 (R;US)
Ceramic engine parts. January 1972-April 1989 (Citations from the International Aerospace Abstracts data base). Report for January 1972-April 1989, 14:36447 (R;US)
Computerized tomography: technology and equipment. January 1977-February 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1977-February 1988, 14:37323 (R;US)
Electrostatic precipitators. January 1979-April 1989 (Citations from the NTIS data base). Report for January 1979-April 1989, 14:37193 (R;US)
Laser materials: radiation damage. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:37400 (R;US)
Lead pollution: public health hazards and environmental toxicity. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:37332 (R;US)
Lead: occupational health hazards. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:37331 (R;US)
Nondestructive testing for microelectronics, semiconductors, and superconductors. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:36993 (R;US)
Ocean waste disposal: outfall sewers. January 1977-April 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-April 1989, 14:36441 (R;US)
Sewage-sludge pretreatment and disposal. December 1981-February 1988 (Citations from the NTIS data base). Report for December 1981-February 1988, 14:36439 (R;US)
Sewage-sludge pretreatment and disposal. March 1988-April 1989 (Citations from the NTIS data base). Report for March 1988-April 1989, 14:36440 (R;US)
Toxicology of ozone. April 1988-April 1989 (Citations from the NTIS data base). Report for April 1988-April 1989, 14:37394 (R;US)
Toxicology of ozone. January 1970-March 1988 (Citations from the NTIS data base). Report for January 1970-March 1988, 14:37393 (R;US)

Natural Environment Research Council, Plymouth (UK). Plymouth Marine Lab.
Prediction of post barrage densities of shorebirds. V. 4. Birds, 14:35945 (R;GB)
Prediction of post barrage densities of shorebirds. V. 3. Invertebrates, 14:35946 (R;GB)

Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR)
Radiation hygiene. Collection of scientific papers, 14:37645 (R;SU;In Russian)

Naval Academy, Annapolis, MD (USA)
Development of an engineering definition of the extent of J singularity controlled crack growth, 14:36579 (R;US)

Naval Ocean Systems Center, San Diego, CA (USA)
Laser action from syn-(methyl,methyl) bimane, 14:36958 (R;US)

Naval Postgraduate School, Monterey, CA (USA)
Analysis of existing advanced data models and their applicability as a model for a multimedia data-base management system. Master's thesis, 14:37817 (R;US)
Investigation of the production of nitric oxide by soft solar x rays in the e-region of the ionosphere. Master's thesis, 14:37449 (R;US)

Navigation and System Modification, Knoxville, TN (USA)
Coal traffic on the Tennessee River Waterway to year 2000, 14:35579 (R;US)

Nebraska Univ., Lincoln, NE (USA)
Fundamental magnetic studies of iron-rare-earth-metalloid alloys: Technical performance report, 14:36483 (R;US)

Netherlands Energy Research Foundation, Petten (Netherlands)
Leaching characteristics of incinerator residues and potential for modification of leaching, 14:36431 (R;NL)

Nevada Univ., Las Vegas, NV (USA). Water Resources Center
Nevada Test Site Radionuclide Inventory and Distribution Program: Report number 5: Areas 5, 11, 12, 15, 17, 18, 19, 25, 26, and 30, 14:35780 (R;US)

New York Sea Grant Inst., Albany, NY (USA)
Marine biomass: New York State species and site studies. Annual report December 1982-November 1983, 14:35906 (R;US)

Niels Bohr Inst., Copenhagen (Denmark)
What is special about the group of the standard model?, 14:37528 (R;DK)

Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)
Couplings in the heterotic superconformal three generation model, 14:37529 (R;DK)
Non renormalization theorem in bosonized n-string formalism, 14:37555 (R;DK)

Norsk Petroleumsforening, Oslo
Cost effectiveness, 14:35656 (R;NO)

North Carolina State Univ., Raleigh, NC (USA)
Randomized parallel branch-and-bound algorithm, 14:37794 (R;US)

North Dakota Univ., Grand Forks, ND (USA). Dept. of Physics
Role of porosity in supercritical fluid extraction of coal: Technical progress report, 14:35559 (R;US)

North Dakota Univ., Grand Forks, ND (USA). Energy and Mineral Research Center
Ion exchange and soil attenuation of Gulf Coast and Great Plains soils: Final report, 14:37217 (R;US)

Notre Dame Univ., IN (USA). Dept. of Physics
Development of new scintillating fiber detectors for high energy physics applications, 14:37109 (R;US)

Nova, an Alberta Corp., AB (Canada)
Community energy planner, 14:36255 (R;CA)

Nuclear Energy Agency, 75 - Paris (France)
Nuclear Accidents Intervention Levels for Protection of the Public, 14:36155 (R;XN)

Nuclear Energy Board, Dublin (Ireland)
Guidelines for approved medical officers on health surveillance of radiation workers, 14:37644 (R;IE)
Survey of radioactive waste disposal in Ireland, 14:35788 (R;IE)

Nuclear Regulatory Commission, King of Prussia, PA (USA). Region I
NRC TLD [thermoluminescent dosimeter] Direct Radiation Monitoring Network: Progress report, January–March 1989, 14:37228 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering
A study of the use of crosslinked high-density polyethylene for low-level radioactive waste containers, 14:35794 (R;US)

Demonstration of a performance assessment methodology for high-level radioactive waste disposal in basalt formations, 14:35792 (R;US)
Development of an engineering definition of the extent of J singularity controlled crack growth, 14:36579 (R;US)
Mission survey for the Pressure Vessel Research User's Facility (PVRUF), 14:36011 (R;US)
Nuclear plant service water system aging degradation assessment: Phase 1, 14:36166 (R;US)
Post-irradiation fracture toughness characterization of four lab-melt plates: Revision 1, 14:36578 (R;US)
Post-Pennsylvanian reactivation along the Washita Valley fault, southern Oklahoma, 14:37411 (R;US)
Static load cycle testing of a low-aspect-ratio six-inch wall TRG-type structure TRG-4-6 (1.0, 0.25), 14:36091 (R;US)
VAM2D–Variably saturated analysis model in two dimensions: Version 5.0 with hysteresis and chained decay transport: Documentation and user's guide, 14:35793 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services
Nuclear Regulatory Commission issuances, March 1989, 14:36048 (R;US)
Nuclear Regulatory Commission issuances, April 1989, 14:36049 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of High-Level Waste Management
Analysis of alternative waste isolation concepts, 14:35795 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Operational Events Assessment
Closeout of IE Bulletin 80-09: Hydramotor actuator deficiencies, 14:36164 (R;US)
Closeout of IE Bulletin 83-06: Nonconforming materials supplied by Tube-Line Corporation Facilities at Long Island City, New York; Houston, Texas; and Carol Stream, Illinois, 14:35841 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Inspection and Safeguards
Fitness for duty in the nuclear power industry: Responses to public comments, 14:36052 (R;US)
Fitness for duty in the nuclear power industry: A review of technical issues, 14:36162 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications
Data base on dose reduction research projects for nuclear power plants: Volume 3, 14:36160 (R;US)
Health effects models for nuclear power plant accident consequence analysis: Low LET radiation: Part 2, Scientific bases for health effects models, 14:37380 (R;US)
Occupational dose reduction at nuclear power plants: Annotated bibliography of selected readings in radiation protection and ALARA: Volume 4, 14:36159 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution
Recommendations for resolution of public comments on USI [Unresolved Safety Issues] A-40, "Seismic Design Criteria", 14:36165 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research
A summary of hydrogen-air detonation experiments, 14:36161 (R;US)
Aerosol sampling and Transport Efficiency Calculation (ASTEC) and application to surtsey/DCH aerosol sampling system: Code version 1.0: Code description and user's manual, 14:36163 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Information Resources Management
Licensed operating reactors status summary report, data as of April 30, 1989, 14:35984 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation
Compilation of fastener testing data received in response to NRC Compliance Bulletin 87-02, 14:36051 (R;US)
Technical Specifications, Seabrook Station, Unit 1 (Docket No. 50-443): Appendix "A" to License No. NPF-67, 14:36050 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research
Proceedings of the 20th DOE/NRC nuclear air cleaning conference: Sessions 1–5, 14:37200 (R;US)
Proceedings of the 20th DOE/NRC nuclear air cleaning conference: Sessions 6–15, 14:37201 (R;US)
Proceedings of the 20th DOE/NRC nuclear air cleaning conference: An index to the 1st–20th AEC/ERDA/DOE and DOE/NRC nuclear air cleaning conferences, 14:37202 (R;US)

O

Oak Ridge Gaseous Diffusion Plant, TN (USA)
Approaching distributed database applications using a programmable terminal emulator, 14:37819 (R;US)

Oak Ridge National Lab., TN (USA)
A high-intensity plasma-sputter heavy negative ion source, 14:37467 (R;US)
A lithium liquid metal ion source suitable for high voltage terminal applications, 14:37466 (R;US)
A remote sensor/cable identifier, 14:37001 (R;US)
A symbolic generator of state equations for modeling of dynamic systems based on the electrical network analog paradigm, 14:37014 (R;US)
A virtual zero-time, monolithic systolic sorting array, 14:37798 (R;US)
Alpha-particle losses in compact torsatron reactors, 14:37715 (R;US)
An experimental study of the effect of stainless steel cladding on the structural integrity of flawed steel plates in bending, 14:36082 (R;US)
An update on standards for radiation in the environment and associated estimates of risk, 14:37345 (R;US)
Assessment of potential worker exposure for the Tumulus Disposal Demonstration Project: Fiscal year 1988 annual report, 14:35798 (R;US)
Attained energy densities and neutral pion spectra in nucleus-nucleus collisions at 200 GeV/nucleon, 14:37597 (R;US)
Bioprocessing research for energy applications, 14:35905 (R;US)
Boiling water reactor, 14:35994 (TG;US)
Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1, 14:35538 (R;US)
Bristol Babcock DPC 3330 controller evaluation, 14:36417 (R;US)
Bulk Shielding Facility quarterly report, January, February, and March 1989, 14:36125 (R;US)
Cask drop testing and analysis, 14:36869 (R;US)
Chaotic behavior in a new class of parallel optimization algorithms, 14:37799 (R;US)
Characterization and subsequent utilization of microbially solubilized coal: Preliminary studies, 14:35519 (R;US)
Characterization of fiber-reinforced particulate filters, 14:35961 (R;US)
Chemical and nuclear emergencies: Interchanging lessons learned from planning and accident experience, 14:37344 (R;US)
Conservation and Renewable Energy Program bibliography, 1989 Edition, 14:36370 (R;US)
Contamination of reflective foils in horizontal applications and its effect on thermal performance, 14:36375 (R;US)
Correlation of recent fission product release data, 14:36110 (R;US)
Effect of peak thermal strain on simplified ratchetting analysis procedures, 14:36084 (R;US)
Electrically stabilized expanded beds for sorption separations, 14:36706 (R;US)
Electronic communication and data transfer productivity enhancements, 14:37800 (R;US)
Energy technology R and D: What could make a difference?: A study by the staff of the Oak Ridge National Laboratory: Part 1, Synthesis report: Volume 1, 14:36245 (R;US)
Environmental Regulatory Update Table, May 1989, 14:37220 (R;US)
Estimates of CO_2 emissions from fossil fuel burning and cement manufacturing, based on the United Nations energy statistics

and the US Bureau of Mines cement manufacturing data, 14:37173 (R;US)
Estimating departure times from traffic counts using dynamic assignment, 14:36402 (R;US)
Estimating fracture toughness using tension or ball indentation tests and a modified critical strain model, 14:36475 (R;US)
Evaluation of weldment creep and fatigue strength-reduction factors for elevated-temperature design, 14:36083 (R;US)
Explosives detection with an ion trap mass spectrometer, 14:37148 (R;US)
Full-pattern refinement of crystalline polymer fibers based on diffractometer measurements, 14:36664 (R;US)
Fusion reactor materials semiannual progress report for the period ending September 30, 1988, 14:37759 (R;US)
Genetics of early embryo survival, 14:37314 (R;US)
Impact of an apparent radiation embrittlement rate on the life expectancy of PWR [pressurized-water-reactor] vessel supports, 14:36006 (R;US)
Impacts of DOE Order 5820.2A on Oak Ridge National Laboratory, 14:37227 (R;US)
Insurance and bonding, 14:37401 (R;US)
International conference on analytical chemistry in nuclear technology, June 5–8, 1989, Karlsruhe, France: Foreign trip report, 14:36729 (R;US)
Laboratory testing of a fluidized-bed dry-scrubbing process for the removal of acidic gases from a simulated incinerator flue gas: Final report, 14:36416 (R;US)
Least-cost planning in the utility sector: Progress and challenges, 14:36338 (R;US)
Marketing for Oak Ridge technology transfer, 14:36242 (R;US)
Microbial coal liquefaction, 14:36520 (R;US)
Mission survey for the Pressure Vessel Research User's Facility (PVRUF), 14:36011 (R;US)
Monitoring of corrosion in ORGDP cylinder yards, 14:35777 (R;US)
Multi-energy neutron detector for counting thermal neutrons, high-energy neutrons, and gamma photons separately, 14:37133 (R;US)
Multiphoton ionization of $(Xe)_n$ and $(NO)_n$ clusters using a picosecond laser, 14:37464 (R;US)
Negotiating a license to government technology, 14:36241 (R;US)
Noncontacting laser diffraction strain extensometer for material properties characterization at high temperatures, 14:36617 (R;US)
Nonfilm radiography at the Oak Ridge Y-12 Plant, 14:37121 (R;US)
Nuclear Medicine Program progress report for quarter ending December 31, 1988, 14:37320 (R;US)
Numerical modeling and tracer study of groundwater—Yenliao Nuclear Power Plant site, Taipei, Taiwan, June 5–12, 1988: Foreign trip report, 14:35796 (R;US)
Oak Ridge National Laboratory Health and Safety Long-Range Plan: Fiscal years 1989–1995, 14:36880 (R;US)
ORMONTE: An uncertainty analysis code for use with user-developed systems models on mainframe or personal computers: A user's guide, 14:37808 (R;US)
Overview of the US program of controls for advanced reactors, 14:36027 (R;US)
Panel discussion: Progress and plans for magnetic fusion: Summary of comments on recent progress in fusion research at the Oak Ridge National Laboratory, 14:37716 (R;US)
Pasture grass interception and retention of ^{131}I, ^{7}Be, and insoluble microspheres deposited in rain, 14:37203 (R;US)
Probing nuclear currents with dilepton production in ultrarelativistic heavy-ion collisions, 14:37498 (R;US)
Proceedings of the 20th DOE/NRC nuclear air cleaning conference: An index to the 1st–20th AEC/ERDA/DOE and DOE/NRC nuclear air cleaning conferences, 14:37202 (R;US)
Process and preparation facility for uranium tetrafluoride, 14:35760 (TG;US)
Process and preparation facility for double uranium fluoride, 14:35761 (TG;US)
Radiation exposure inside reinforced concrete buildings at Nagasaki, 14:37381 (R;US)
Radioactive materials packaging standards and regulations: Making sense of it all, 14:35778 (R;US)
Recent results on cleaning and conditioning the ATF vacuum system, 14:37758 (R;US)
Reinforced confinement in a nuclear reactor, 14:36012 (TG;US)
Relaxation response of A533B steel from 25 to 600°C, 14:36474 (R;US)
Risk assessment and late effects of radiation in low-earth orbits, 14:37343 (R;US)
Saturation behavior of parametric four-wave mixing due to two-photon interference effect, 14:37465 (R;US)
Simulation of a continuous rotary dissolver, 14:35763 (R;US)
Structural ceramics in the advanced materials world, 14:36473 (R;US)
Structural integrity evaluation based on an innovative field indentation microprobe, 14:36984 (R;US)
Sulfidation/oxidation properties of iron-based alloys containing niobium and aluminum, 14:35539 (R;US)
Supervisory control in a distributed, hierarchical architecture for a multimodular LMR, 14:36094 (R;US)
Techniques for producing monodispersed biocatalyst beads for use in columnar bioreactors, 14:36665 (R;US)
The amorphous to gamma transformation in ion implanted Al_2O_3, 14:36618 (R;US)
The Sigmajig: An improved hot-cracking test, 14:36479 (R;US)
The texture variation in extruded graphite, 14:36663 (R;US)
The value of marginal analysis in electric power system operations, 14:36274 (R;US)
Thirteenth radioactive conference, radiocarbon measurements and applications, Dubrovnik, Yugoslavia, June 20–25, 1988: Foreign trip report, 14:37406 (R;US)
Tool integration and enhancement for standard cell designs, 14:37000 (R;US)
Transport survey calculations using the spectral collocation method, 14:37714 (R;US)
Transverse energy scaling and energy density estimates from ^{16}O- and ^{32}S-induced reactions, 14:37562 (R;US)
[2nd international symposium on high-temperature corrosion of advanced materials and coatings, Les Embiez, France, and visit to Manchester, England, May 19–27, 1989]: Foreign trip report, 14:35536 (R;US)
[2nd international symposium on high-temperature corrosion of advanced materials and coatings, Les Embiez, France, May 22–26, 1989]: Foreign trip report, 14:35537 (R;US)
[Analytical chemistry in nuclear technology, Karlsruhe, Germany and visit to Seibersdorf, Austria, June 3–22, 1989]: Foreign trip report, 14:35766 (R;US)
[Biospheric model validation in urban, terrestrial, and aquatic environments, Budapest, Hungary, Vienna, Austria, Neuherberg, and Schmallenberg, W. Germany, April 25–May 12, 1988]: Foreign trip report, 14:37661 (R;US)
[Discussion of domestic refrigerator/freezer (R/F) design for non-azeotropic refrigerant mixtures (NARMs), Hannover, W. Germany, and visit to Kassel, W. Germany, May 2–5, 1989]: Foreign trip report, 14:36387 (R;US)
[Discussions with International Energy Agency's Center for the Analysis and Dissemination of Demonstrated Energy Technologies concerned with database and analysis study series of reports, Sittard, Netherlands, May 22–26, 1989]: Foreign trip report, 14:37821 (R;US)
[Electron-ion cross beam experiments and ion-atom collisions, Louvain-la-Neuve, Belgium, Paris, France, Utrecht, the Netherlands, and Groeningen, the Netherlands, April 30–May 28, 1989]: Foreign trip report, 14:37474 (R;US)
[Environmental assessment for radioactive waste disposal, Daeduk, South Korea, May 12–June 14, 1989]: Foreign trip report, 14:35797 (R;US)
[European aerosol conference and workshop on aerosol deposition to natural surfaces, Lund, Goteborg, and Stockholm, Sweden, and Oslo, Norway, August 29–September 17, 1988]: Foreign trip report, 14:37176 (R;US)
[Fifth international congress of plant pathology, Kyoto, Japan, August 23–27, 1988]: Foreign trip report, 14:37175 (R;US)
[International conference on electrostatic accelerators (ICEA), Strasbourg, France and Heidelberg, Germany, and discussion

of electron cyclotron resonance ion sources, Grenoble, France, May 23–29, 1989]: Foreign trip report, 14:37091 (R;US)
[International conference on Thermal reactor safety, October 2-7, 1988, Avignon, France]: Foreign trip report, 14:36167 (R;US)
[International Energy Agency third experts meeting of Annex 20 on Airflow patterns within buildings, May 30–June 2, 1989, Aalborg, Denmark; June 1, Aalborg University, Denmark; June 5-6, Taastrup, Denmark]: Foreign trip report, 14:36388 (R;US)
[International workshop on terrestrial field testing of pesticide, Cambridge, United Kingdom, September 11–16, 1988]: Foreign trip report, 14:37335 (R;US)
[Radiological incidents, Tours, France, June 18–June 24, 1988]: Foreign trip report, 14:37334 (R;US)
[Twelfth international conference on cyclotrons and their applications, Berlin, W. Germany, and visit to Hahn-Meitner-Institute, May 8–12, 1989]: Foreign trip report, 14:37044 (R;US)
[Working meeting of the International Energy Agency Annex 14 on Working fluids and transport phenomena in advanced absorption heat pumps, May 28-30, 1989, Stockholm, Sweden; May 31, 1989, Nykoping, Sweden; June 5, 1989, Stuttgart, West Germany; June 6, 1989, Essen, West Germany; June 7, 1989, Munich, West Germany]: Foreign trip report, 14:36389 (R;US)
[Workshop on global vegetation models, Laxenburg, Austria, 3 June–9 August 1988]: Foreign trip report, 14:37174 (R;US)

Oak Ridge National Lab., TN (USA). Data Systems Research and Development Program
Corporate data base machines: Market analysis for the Joint Staff, 14:37820 (R;US)

Oak Ridge Technical Enterprises, TN (USA)
Plasma current startup by lower hybrid waves in the JIPP T-IIU tokamak, 14:37730 (R;JP)

Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. (Austria)
Automatic programmable air sampling stations. Instruction manual, 14:37118 (R;AT;In German)
HTR research and development in Austria. 1987/1988 progress report, 14:36025 (R;AT)

Oklahoma State Univ., Stillwater, OK (USA). School of Chemical Engineering
Phase equilibrium data for development of correlations for coal fluids: Report for the period April 15, 1989–June 15, 1989, 14:35530 (R;US)

Ontario Energy Board, Toronto, ON (Canada)
Gas supply. Reference from the Lieutenant Governor in Council, 14:35678 (R;CA)

Ontario Hydro Research Div., Toronto, ON (Canada)
TV interference study on distribution test line, 14:35974 (R;CA)
Vibration monitoring of main coolant pumps: Guideline and reference data: Final report, 14:36096 (R;US)

Ontario Ministry of Natural Resources, Toronto, ON (Canada). Fisheries Branch
Observations of lake trout (Salvelinus namaycush) spawning behaviour in low pH lakes near Sudbury, Ontario, 14:37391 (R;CA)
Preliminary assessment of the current impact and potential risk of acidic deposition on walleye populations in Ontario, 14:37392 (R;CA)

Ontario Ministry of the Environment, Toronto, ON (Canada)
A Citizen's guide to environmental assessment, 14:36270 (R;CA)

Oxford Univ. (UK)
XUV laser amplification in recombining laser-produced plasmas, 14:37489 (D;GB)

Oxford Univ. (UK). Dept. of Theoretical Physics
Couplings in the heterotic superconformal three generation model, 14:37529 (R;DK)

P

Pacific Northwest Lab., Richland, WA (USA)
324 and 325 Building Hot Cell Cleanout Program: Air lock cover block refurbishment, 14:35803 (R;US)
An evaluation of near-field host rock temperatures for a spent fuel repository, 14:35805 (R;US)
Calculated and measured depth dose profiles in a phantom exposed to neutron radiation fields, 14:37662 (R;US)
Capillary zone electrophoresis-mass spectrometry of peptides and proteins, 14:37141 (R;US)
Electrospray ionization and collision induced dissociation of large multiply charged ions, 14:37475 (R;US)
Electrospray ionization-mass spectrometry and tandem mass spectrometry, 14:36846 (R;US)
Experiences with a large load research project in the Pacific Northwest: ELCAP [End-Use Load and Consumer Assessment Program], 14:36340 (R;US)
Fitness for duty in the nuclear power industry: A review of technical issues, 14:36162 (R;US)
Hanford Environmental Dose Reconstruction Project: Monthly report, 14:37382 (R;US)
Hanford Site implementation of the National Environmental Policy Act: Activities tracking, 14:37276 (R;US)
Life-span effects of ionizing radiation in the beagle dog: A summary account of four decades of research funded by the US Department of Energy and its predecessor agencies, 14:37383 (R;US)
Nuclear plant service water system aging degradation assessment: Phase 1, 14:36166 (R;US)
Oil use and oil dependency: Long-term issues, 14:35654 (R;US)
Performance monitoring protocols, 14:36393 (R;US)
Radial distributions of energy deposited along charged particle tracks, 14:37663 (R;US)
Regulatory requirements important to Hanford single-shell tank waste management decisions, 14:35801 (R;US)
Review of second law analysis techniques applicable to the Energy Conversion and Utilization Technologies Thermal Sciences Program, 14:36226 (R;US)
Speculation on the mechanism(s) of electrospray ionization, 14:37143 (R;US)
Technology assessment guide for application of engineered sorbent barriers to low-level radioactive waste disposal sites, 14:35802 (R;US)
The aquifer chill storage project at the University of Alabama, Tuscaloosa: Progress report for 1985 and 1986, 14:36218 (R;US)
The need for control agencies to update today's conceptual basis for groundwater quality requirements and subsurface evaluation guidelines, 14:37223 (R;US)
The on-line combination of capillary isotachophoresis with mass spectrometry, 14:37142 (R;US)
Theoretical analysis of phase transformations in Fe-Ni "Invar"-type alloys, 14:36580 (R;US)
Treatment needs for Greater-Than-Class C low-level waste, 14:35804 (R;US)
TRUEX process laboratory studies with Hanford complexant concentrate waste: Part 2, Test for solvent poisoning, 14:35806 (R;US)
US Department of Energy radioisotope customers with summary of radioisotope shipments, FY 1988, 14:35856 (R;US)

Parameter, Inc., Elm Grove, WI (USA)
Closeout of IE Bulletin 80-09: Hydramotor actuator deficiencies, 14:36164 (R;US)
Closeout of IE Bulletin 83-06: Nonconforming materials supplied by Tube-Line Corporation Facilities at Long Island City, New York; Houston, Texas; and Carol Stream, Illinois, 14:35841 (R;US)

Paris-11 Univ., 91 - Orsay (France)
Characterization by positron annihilation of vacancies in gallium arsenide, 14:36675 (R;FR;In French)
Dynamical properties in metallic reentrant in spin glasses studied by inelastic neutron scattering, 14:36546 (R;FR;In French)
Theoretical and numerical study of cyclotron in space charge conditions, 14:37052 (R;FR;In French)

Paris-11 Univ., 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse
Dipole octupole correlations in a boson model and evidence for their existence in nuclei, 14:37631 (R;SU)

Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire
Collective structures in ^{185}Hg, 14:37591 (R;FR)
Decay of doubly-odd nucleus ^{184}Ir, 14:37594 (R;FR)
Dynamical aspects of violent collisions in Ar + Ag reactions at E/A = 27 MeV, 14:37472 (R;FR)

Excitation of the Δ resonance in heavy ion charge exchange reactions, 14:37628 (R;FR)
Experiments on secondary ion emission with multicharged keV ion bombardement, 14:37471 (R;FR)
Fusion-fission of heavy systems: influence of the entrance channel mass asymmetry, 14:37578 (R;FR)
High lying and high spin states in heavy nuclei via transfer reactions, 14:37629 (R;FR)
Interaction of 20-100 MeV/u heavy ions with cold matter, 14:37573 (R;FR)
Isovector and isoscalar spin-flip excitations in even-even s-d shell nuclei excited by inelastic proton scattering, 14:37630 (R;FR)
Multiple angular scattering of heavy ions $^{16-17}O$, ^{40}Ar, ^{86}Kr, ^{100}Mo at intermediate energies (20-90 MeV/u), 14:37682 (R;FR)
Multiplicity of neutrons from violent heavy-ion collisions: ^{40}Ar + Th and U from 10 to 77 MeV/u, 14:37603 (R;DE)
Production of 400 MeV/u radioactive ion beams for therapy purposes, 14:37574 (R;FR)
Selective population of the highest spin n-p states in heavy nuclei via the (α, d) reaction at 218 MeV, 14:37588 (R;FR)
Shape coexistence at high spin in ^{187}Au, 14:37593 (R;FR)
Shape transition in neutron deficient PT isotopes, 14:37592 (R;FR)
Spin value of ^{184}Ir ground state, 14:37627 (R;FR)

Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire
Charm photoproduction mechanisms and a few preliminary results from the NA 14' experiment, 14:37554 (R;FR)
First evidence for direct cp violation, 14:37544 (R;FR)
Introduction to gravity and cosmology, 14:37439 (R;FR)
Measurement of the decays K_L -> 2γ and K_S -> 2γ, 14:37575 (R;FR)
Neutrino counting in single photon experiments, 14:37509 (R;FR)
Radiative decay of J/psi into $\gamma\pi^+\pi^-$, 14:37571 (R;FR)
Results of the Frejus experiment on nucleon decay, 14:37707 (R;FR)
Study of atmospheric neutrino interactions with the Frejus detector, 14:37706 (R;FR)
Tests of QCD in photoproduction, 14:37543 (R;FR)
Three and five photon decays of the J/PSI (3097), 14:37553 (R;FR)

Paris-7 Univ., 75 (France)
Heavy ions beam axial injection tudy in a compact cyclotron, 14:37075 (R;FR;In French)

Pechan (E.H.) and Associates, Inc., Springfield, VA (USA)
User's guide to CONVEST, 14:37803 (R;US)

PEI Associates, Inc., Cincinnati, OH (USA)
Evaluation of asbestos levels in two schools before and after asbestos removal. Final report, 14:37181 (R;US)
User's guide to SDM- a Shoreline Dispersion Model, 14:37177 (R;US)

Pennsylvania Dept. of Environmental Resources, Harrisburg, PA (USA). Bureau of Radiation Protection
Appalachian States Compact Low-Level Radioactive Waste management survey, 1987, 14:35799 (R;US)

Pennsylvania State Univ., University Park, PA (USA)
[Comparison of the activity of subsurface and surface microorganisms and their anaerobic transformation of heterocyclic compounds]: Progress report, July 1, 1987–June 30, 1989, 14:37326 (R;US)

Pennsylvania State Univ., University Park, PA (USA). Coll. of Earth and Mineral Sciences
Thermal stability of jet fuel: Second quarterly report, January–March 1989, 14:35643 (R;US)

Pennsylvania Univ., Philadelphia, PA (USA). Board of Trustees
Staging in layer intercalates: Progress report, 1 June 1988–31 May 1989, 14:36667 (R;US)

Pennsylvania Univ., Philadelphia, PA (USA). Dept. of Chemistry
[Dynamics of vibrationally excited polyatomic molecules and their unstable isomers on the electronic ground state potential surface]: Progress report, 14:36740 (R;US)

Pittsburgh Univ., PA (USA)
The physics of pattern formation at liquid interface: Progress report, June 1, 1988–May 31, 1989, 14:37664 (R;US)

Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering
Studies of dense phase cohesive coal transport in plugs: Quarterly report, April–June 1989, 14:35578 (R;US)

Pittsburgh Univ., PA (USA). Dept. of Materials Science and Engineering
Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1, 14:35538 (R;US)
Coal ash deposition, interaction with metal substrates and deposit build up: Summary report, 26 February 1989–25 May 1989, 14:35586 (R;US)

Pittsburgh Univ., PA (USA). Dept. of Physics and Astronomy
Far- and mid-infrared properties of metal-insulator composite materials. Annual letter report, 1 January-31 December 1988, 14:36658 (R;US)

Planning and Management Consultants Ltd., Carbondale, IL (USA)
Examination of noise-management approaches in the United States. Final report, 14:37399 (R;US)

PN Research Projects, Sydney, BC (Canada)
Distribution, abundance and age segregation of bowhead whales in the southeast Beaufort Sea, August-September 1986, 14:35661 (R;CA)

Policy Research Associates, Inc., Reston, VA (USA)
Information and automation technology: Serving electric utility customers in the 1990s: Conference proceedings, 14:36257 (R;US)

Portland State Univ., OR (USA). Dept. of Chemistry
Improved acid electrolytes: synthesis and structure of fluorine-containing sulfonic acids for fuel cells. Final report, July 1987-August 1988, 14:36363 (R;US)

Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)
Development of glass melter for the PNC Tokai Vitrification Facility, 14:35800 (R;JP)

Princeton Univ., NJ (USA)
Physics of spin-polarized atomic vapors. Final report, 1 October 1986-30 April 1988, 14:37461 (R;US)

Princeton Univ., NJ (USA). Plasma Physics Lab.
Atomic physics studies of highly charged ions on tokamaks using x-ray spectroscopy, 14:37738 (R;US)
Formulation and solution of the delayed gamma dose rate problem using the concept of effective delayed gamma production cross section, 14:37772 (R;US)
Multiple mode model of tokamak transport, 14:37740 (R;US)
On field line resonances of hydromagnetic Alfven waves in dipole magnetic field, 14:37458 (R;US)
Pulse length assessment of compact ignition tokamak designs, 14:37739 (R;US)
Tokamak electrical conductivity modified by electrostatic trapping in the applied electric field, 14:37741 (R;US)

Public Works Canada, Ottawa, ON (Canada)
Thermal environment evaluation, 14:36394 (R;CA;In French and English)
Thermal resistance measurement, 14:36396 (R;CA;In English and French)
Thermographic inspections of building enclosures, 14:36395 (R;CA;In English and French)

Purdue Univ., Lafayette, IN (USA). School of Chemical Engineering
Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, January 15, 1989–April 15, 1989, 14:35553 (R;US)

Purdue Univ., Lafayette, IN (USA). School of Electrical Engineering
Non-linear optical interactions involving the real Gaussian field: Annual technical progress report, August 1, 1986–July 31, 1989, 14:37134 (R;US)

R

Radian Corp., Austin, TX (USA)
Stretford chemistry and analytical methods handbook. Topical report, 14:35675 (R;US)

RCG/Hagler, Bailly, Inc., Washington, DC (USA)
Energy in West and Central Africa: issues, problems, and donor activities. Final report, 14:36261 (R;US)

Rensselaer Polytechnic Inst., Troy, NY (USA)
Microstructural refinement of W-Ni-Fe heavy alloys by alloying additions, 14:36462 (R;US)
Recycling of cellulose enzyme complex after cellulose hydrolysis. Final report, 14:35863 (R;US)
Wood sugars to energy-intensive organic chemicals: Phase 1. Final report, 14:35858 (R;US)

Research and Productivity Council, NB (Canada)
Modifications of existing testing facilities, optimization of hydroretorting conditions, and assessment of Canadian oil shales as source of synthetic fuels. Final report, 14:35730 (R;CA)

Risoe National Lab., Roskilde (Denmark)
Implementation of computer programmes for fitting of positron annihilation spectra on "personal computers". Final report for the period 1 May 1986 - 14 June 1988, 14:37468 (R;XA)

Rochester Univ., NY (USA)
Molecular basis of RNA catalysis. Annual report, March 1988-February 1989, 14:37301 (R;US)

Rochester Univ., NY (USA). Dept. of Biophysics
A soliton mechanism for DNA melting: Progress report, November 1, 1988–October 31, 1989, 14:37298 (R;US)

Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant
A comprehensive guide to the literature on acoustic emission from composites: Supplement 2, 14:36994 (R;US)
Electrorefining cell evaluation, 14:35758 (R;US)
Studies on work-softening processes in the hot forming of austenitic steel, 14:36581 (TJ;US)
TRIFID [TRansuranic Isotopic Fraction Interrogation Device]: A second generation plutonium isotopic analysis system, 14:35843 (R;US)
Use of nuclear material control specialists for material surveillance, 14:35844 (R;US)

Rockwell International Corp., Thousand Oaks, CA (USA). Science Center
Transformation toughening of ceramics. Final report, 1 September 1985-31 August 1988, 14:36612 (R;US)

Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)
Below Regulatory Concern Owners Group: Assessment of the IMPACTS-BRC code: Final report, 14:35786 (R;US)

Royal Aircraft Establishment, Farnborough (UK)
Particle transport simulation for spaceborne, NaI gamma-ray spectrometers, 14:37129 (R;GB)

Ruhrkohle A.G., Essen (Germany, F.R.)
Improvement of work safety and strain reduction when equipping thin faces through the development and testing of a turning and swinging installation for shield support units. Final report, 14:35596 (R;DE;In German)

S

Sachtleben Chemie G.m.b.H., Duisburg (Germany, F.R.)
Waste heat recovery from a sulfuric acid plant, 14:36414 (R;DE;In German)

San Diego State Univ., CA (USA). Dept. of Physics
Development of a carbonaceous selective absorber for solar thermal energy collection and process for its formation: Final report, 14:35929 (R;US)

Sandia National Labs., Albuquerque, NM (USA)
A demonstration of ASSESS: Analytic System and Software for Evaluating Safeguards and Security, 14:35850 (R;US)
A fully automated, single-connection tester for T/R modules, 14:37146 (R;US)
A method of removing oxides from the surface of Fe-Ni-Co alloy particles by chemical etching, 14:36582 (R;US)
A radiation-hardened 16/32-bit microprocessor, 14:37130 (R;US)
A recuperative gas fired forge furnace, 14:37023 (R;US)
A solid state video recorder as a direct replacement of a mechanically driven disc recording device in a security system, 14:37812 (R;US)
A summary of hydrogen-air detonation experiments, 14:36161 (R;US)
A synopsis of analyses (1981–87) performed to assess the stability of underground excavations at Yucca Mountain: Yucca Mountain Project, 14:35808 (R;US)
A technique for efficiently cleaning and conditioning low- and medium-energy accelerators, 14:37045 (R;US)
A test system for thermomechanical fatigue of solder joints, 14:36585 (R;US)
A wind shielded fire test facility, 14:36887 (R;US)
Advanced Small Site Program, 14:37789 (R;US)
Aerosol sampling and Transport Efficiency Calculation (ASTEC) and application to surtsey/DCH aerosol sampling system: Code version 1.0: Code description and user's manual, 14:36163 (R;US)
An evaluation of the polyester/polyethylene badge packet as an identification card, 14:37792 (R;US)
An improved design for stretched-membrane heliostats, 14:35926 (R;US)
Annealing and strain effects on Tl-Ba-Ca-Cu-O crystals and ceramics, 14:36647 (R;US)
Argonne Unified Safeguard: An integrated materials monitoring/tracking and accounting system, 14:35846 (R;US)
BUCKSHOT simulations of beam injection on the recirculating linac, 14:37093 (R;US)
Communication techniques for safely transmitting and verifying unique signals, 14:37157 (R;US)
Compound-lens diode for HERMES III, 14:37092 (R;US)
Computer site threat identification and analysis, 14:37809 (R;US)
Damage predictions for wind turbine components using the LIFE2 computer code, 14:36881 (R;US)
Demonstration of a performance assessment methodology for high-level radioactive waste disposal in basalt formations, 14:35792 (R;US)
Demonstrations of a real time personnel and material tracking system, 14:37791 (R;US)
Description of the NanoΔIndenter™; An ultra-low-load microhardness indentation test machine, 14:36996 (R;US)
Design of an advanced entry control system, 14:36886 (R;US)
Development of a thin wall graphite/polyimide composite pressure vessel with a large aspect ratio, 14:36884 (R;US)
Development of the BOLVAPS [Boil-Off Lithium VAPor Source] lithium vapor source for the PBFA-II [Particle Beam Fusion Accelerator II] accelerator, 14:37775 (R;US)
Diamagnetic shielding and flux creep in a Tl-Ba-Ca-Cu-O thin film, 14:36584 (R;US)
Droplet sizing calibration of the Phase Doppler Particle Analyzer, 14:37145 (R;US)
Effective implementation of safeguards and security requirements, 14:37790 (R;US)
Electrohydrodynamically driven, large-area liquid metal ion source for inertial confinement fusion, 14:37778 (R;US)
ELLIPSE user's manual and program reference, 14:37811 (R;US)
Energy accommodation modeling of rarefied flow over re-entry vehicle geometries using DSMC [Direct Simulation Monte Carlo], 14:36409 (R;US)
Evaluation of commercially available lighting design software, 14:36397 (R;US)
External ion beam analysis of the TFTR [Tokamak Fusion Test Reactor] bumper limiters, 14:37777 (R;US)
Field evaluation of new exterior video motion detection systems, 14:36892 (R;US)
Finite control volume modeling of laminar and turbulent flow of air in an enclosure, 14:37485 (R;US)
Formation, motion and high temperature superconductivity of large bipolarons, 14:37698 (R;US)
Guidelines for preparing a contractor safety plan, 14:37402 (R;US)

Health effects models for nuclear power plant accident consequence analysis: Low LET radiation: Part 2, Scientific bases for health effects models, 14:37380 (R;US)
Interstage closure times for the rimfire multistage gas switch, 14:37773 (R;US)
Investigation of cask contamination weeping: A progress report, 14:36888 (R;US)
Ion diode experiments on PBFA [Particle Beam Fusion Accelerator] II: Workshop on applications of high power switching, 14:37780 (R;US)
Ion production on the PI-110A accelerator, 14:37776 (R;US)
Jitter improvement of the 12-MV oil switches on Aurora, 14:36882 (R;US)
LineCAP [Line/Circuit Analysis Program]: Cross-coupling on PC [printed circuit] board traces including discontinuities and circuit elements, 14:37015 (R;US)
Management Information Database System, 14:37822 (R;US)
Mechanisms that control the geometry of pulsed Nd:YAG laser welds, 14:36583 (R;US)
MHD calculations of anode plasmas, 14:37483 (R;US)
Modular economical PC-based alarm display system, 14:35845 (R;US)
Numerical analysis of designs to reduce the kinetic energy of Davis Gun pusher plates, 14:36889 (R;US)
Numerical analysis of experimental data to infer plasma opening switches, 14:37016 (R;US)
Numerical solution of the Navier-Stokes equations for three-dimensional incompressible flows with open boundaries, 14:37484 (R;US)
On the limitation of the weak-coupling assumption for crosstalk analysis in an inhomogeneous medium, 14:35975 (R;US)
Pairing in CuO_2 driven by exchange interactions between carriers and localized Cu spins, 14:37476 (R;US)
PDC [polycrystalline diamond compact] bit research at Sandia National Laboratories, 14:35943 (R;US)
Performance of plasma opening switches for the Particle Beam Fusion Accelerator II (PBFA II), 14:37774 (R;US)
Phonon-drag thermoelectric power in high magnetic fields in heterojunctions, 14:37689 (R;US)
Photocurrent variability of discrete bipolar devices, 14:37017 (R;US)
Preliminary analyses in support of in situ thermomechanical investigations, 14:35809 (R;US)
Quantitative infrared spectroscopy of glucose in blood using partial least-squares analyses, 14:37300 (R;US)
Research drilling in young silicic volcanoes, 14:37413 (R;US)
Scattering from fractals, 14:37690 (R;US)
Science guide for the Long Valley Caldera deep hole, 14:37412 (R;US)
Standard terminal panel and UPS [uninterruptible power supply] design for exterior intrusion detectors and data collection applications, 14:37018 (R;US)
Status of light ion approach inertial confinement fusion, 14:37779 (R;US)
Strain to failure of pressurized thick wall cylinders, 14:36995 (R;US)
Stress in dilute suspensions, 14:37482 (R;US)
Systems analysis, long-term radionuclide transport, and dose assessments, Waste Isolation Pilot Plant (WIPP), southeastern New Mexico; March 1989, 14:35811 (R;US)
Target cueing and tracking system for safeguards and security, 14:35851 (R;US)
Techniques for the detection of explosives, 14:37149 (R;US)
The assess facility descriptor module, 14:35847 (R;US)
The ASSESS Neutralization Analysis module, 14:35848 (R;US)
The effects of snow on landmarks in K_u band SAR images, 14:37144 (R;US)
The Outsider interruption algorithm, 14:35849 (R;US)
The PVF2 piezoelectric polymer shock stress sensor: System characterization for application under field test conditions, 14:36891 (R;US)
Thermal strains in a bimaterial joint: Experimental and numerical analysis, 14:36586 (R;US)
Thermal-conductivity data for tuffs from the unsaturated zone at Yucca Mountain, Nevada: Yucca Mountain Project, 14:35807 (R;US)
TRACE - Tamper Resistant Authenticated Camera Enclosure, 14:36890 (R;US)
TRUPACT I filter development: Status report, 14:36883 (R;US)
Two-dimensional effects in hollow core Z-pinches, 14:37743 (R;US)
Two-dimensional effects in imploding plasma liners, 14:37742 (R;US)
Ultrasonic systems and system development at SNL Albuquerque, 14:36997 (R;US)
Using conjoint meshing primitives to generate quadrilateral and hexahedral elements in irregular regions, 14:37810 (R;US)
Waste Isolation Pilot Plant brine field pH measurements: Technique and interpretation, 14:35810 (R;US)

Sandia National Labs., Livermore, CA (USA)
Coal combustion science: Quarterly progress report, January–March 1989, 14:35592 (R;US)
Nonlinear dynamic response of pressurized composite bottles subjected to shock loading, 14:36885 (R;US)

Sargent and Lundy, Chicago, IL (USA)
A comparison of steam-injected gas turbine and combined-cycle power plants: Technology assessment: Final report, 14:35955 (R;US)

Saskatchewan Univ., Saskatoon, SK (Canada)
Study of the conversion of lignocellulosic (aspen) materials to liquid fuels and chemicals, 14:35862 (R;CA)

Saskatchewan Univ., Saskatoon, SK (Canada). Dept. of Geography
A guide to socio-economic impact monitoring in the Northwest Territories, 14:37283 (R;CA)

Savannah River Lab., Aiken, SC (USA)
Life extension approach to the reactor vessel of a nuclear production reactor: Revision 1, 14:36126 (R;US)
Solidification of low-level radioactive waste at the Savannah River Site, 14:35818 (R;US)

Scanda Consultants Ltd., Ottawa, ON (Canada)
The influence of flue sharing on venting performance, 14:37025 (R;CA)
The influence of termination configuration on the flow performance of flues, 14:37024 (R;CA)

Science Applications International Corp., San Diego, CA (USA). Energy Projects Div.
An improved design for stretched-membrane heliostats, 14:35926 (R;US)

Science Council of Canada, Ottawa, ON (Canada). Committee on Industrial Policies
Airborne contaminants and aquatic systems. An assessment of research needs, 14:37395 (R;CA)

Seattle Engineering Dept., WA (USA). Solid Waste Utility
Final Environmental Impact Statement. Qaste reduction, recycling, and disposal alternatives. Recycling potential assessment and waste stream forecast. Volume 2, 14:36434 (R;US)

Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)
Oil at shore and in deposits. Succesive report 1987, 14:35662 (R;NO;In Norwegian)

Serata Geomechanics, Inc., Richmond, CA (USA)
High-performance, intrinsically safe data-acquisition system for underground use. Final report, October 1984-December 1984, 14:35575 (R;US)

SFA Pacific, Inc., Mountain View, CA (USA)
A fundamental research program in coal/heavy oil coprocessing and heavy oil processing: Final report, 14:35523 (R;US)

Shell Research Ltd., Chester (UK)
HEGADAS: heavy gas dispersion program. User's guide, 14:37178 (R;GB)

Sociedade Brasileira de Geologia, Recife, PE (Brazil). Nucleo do Nordeste
Contribution to origin of the reefs in northeastern, 14:37208 (R;BR;In Portuguese)
Deformations in structure of the scapolites from northeast, Brazil, 14:36708 (R;BR;In Portuguese)
Mineralogical behavior of the phosphatic sedimentation in Pernambuco-Paraiba sedimentar coastal basin, 14:37209 (R;BR;In Portuguese)

Mineralogy of bismutotanitalite from Northeastern. Brazil, 14:37210 (R;BR;In Portuguese)
Petrology and mapping of Fe and Ti occurences in Passira country, PE, Brazil, 14:36709 (R;BR;In Portuguese)

Solar Energy Research Inst., Golden, CO (USA)
Biofuels technical information guide, 14:35909 (R;US)
Fuels from microalgae, 14:35910 (R;US)
Materials analysis and device optimization of $CuInSe_2$ solar cells: Annual subcontract report, 16 January 1987–15 January 1988, 14:35913 (R;US)
Photovoltaics advanced research and development: 9th annual review meeting, 14:35908 (R;US)
Polycrystalline cadmium telluride n-i-p solar cell: Annual subcontract report, 1 June 1987–31 August 1988, 14:35912 (R;US)
Progress in parabolic dish technology, 14:35930 (R;US)
Research on stable, high-efficiency, large-area, amorphous-silicon-based submodules, Task B: Semiannual subcontract report, 16 March 1988–15 September 1988, 14:35914 (R;US)
Solar thermal program summary: Volume 2, Research summaries: Fiscal year 1988, 14:35925 (R;US)
Three-dimensional airfoil performance measurements on a rotating wing, 14:35952 (R;US)
Two-terminal $CuInSe_2$-based cascade cells: Annual subcontract report, 16 January 1987–15 January 1988, 14:35911 (R;US)

Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility
CEBAF/SURA 1984 summer workshop: Proceedings, 14:37031 (R;US)
CEBAF/SURA 1986 summer workshop: Proceedings, 14:37569 (R;US)
CEBAF/SURA [Continuous Electron Beam Accelerator Facility]/[Southeastern Universities Research Association] 1988 summer workshop: Proceedings, 14:37566 (R;US)
CEBAF/SURA [Continuous Electron Beam Accelerator Facility]/[Southeastern Universities Research Association] 1987 summer workshop: Proceedings, 14:37567 (R;US)
HUGS at CEBAF [Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility] June 6–24, 1988: Proceedings, 14:37568 (R;US)
Parity violation workshop, 14:37502 (R;US)
Research program at CEBAF (II): Report of the 1986 summer Study Group, June 2–August 29, 1986, 14:37032 (R;US)
Workshop on CEBAF [Continuous Electron Beam Accelerator Facility] spectrometer magnet design and technology: Proceedings, 14:37107 (R;US)

Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility
Laboratory evaluation of MIL-T-83133 JP-8 fuel in army diesel engines. Interim report, October 1984-January 1988, 14:35666 (R;US)

SRI International, Arlington, VA (USA). Strategic Studies Center
Impact upon US security of a South African nuclear-weapons capability. Final technical report, 14:36458 (R;US)

SRI International, Menlo Park, CA (USA)
Exploratory coprocessing research: Quarterly report number 2, for the period December 1, 1988 to February 28, 1989, 14:35527 (R;US)
Factors controlling hydrogenolysis in coal liquefaction: Quarterly report No. 6 for the period October 1–December 31, 1987, 14:35531 (R;US)

SRI International, Menlo Park, CA (USA). Center for Occupational and Environmental Safety and Health
Quick-response evaluation of energy-related occupational safety and health programs. Task Order 1: mortality study of 50 workers exposed to coal-liquefaction processes at a Union Carbide Plant, Institute, West Virginia, 14:35541 (R;US)

SRI International, Menlo Park, CA (USA). Chemical Physics Lab.
The chemical origin of synergy in liquefaction and co-processing, 14:35521 (R;US)

Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)
Radiation exposure to skin following radioactive contamination, 14:37384 (R;DD;In German)

Stanford Linear Accelerator Center, Menlo Park, CA (USA)
An alignment method for the Mark II silicon strip vertex detector using an x-ray beam, 14:37096 (R;US)
Applications of a plasma lens with bootstrap disruption, 14:37065 (R;US)
CP violation in K decays, 14:37533 (R;US)
Heavy quark physics, 14:37532 (R;US)
PHASEFIX: Correcting the tunes of the SLC Arcs, 14:37066 (R;US)
Quark mass ratios in semi-leptonic quark decays, 14:37534 (R;US)
Recent commissioning experience on the SLC Arcs, 14:37095 (R;US)
Review of "close-mass" heavy lepton searches, 14:37514 (R;US)
RF phase distribution systems at the SLC, 14:37094 (R;US)
Silicon PIN diode hybrid arrays for charged particle detection: Building blocks for vertex detectors at the SSC, 14:37119 (R;US)
The search for charged-lepton specific forces and the PEGASYS facility, 14:37531 (R;US)
What do we know (and how) about the CKM [Cabibbo-Kobayashi-Maskawa] matrix, 14:37535 (R;US)
Z^0 physics at the SLC, 14:37513 (R;US)

Stanford Univ., CA (USA)
Application of quaternary phase diagrams to compound semiconductor processing: Progress report, April 1–December 31, 1988, 14:36480 (R;US)

Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.
An engineering model for coal devolatilization: Quarterly report, December 15, 1988–March 15, 1989, 14:35584 (R;US)
Pyrite thermochemistry, ash agglomeration, and char fragmentation during pulverized coal combustion: Quarterly report, December 15, 1988–March 15, 1989, 14:35583 (R;US)

Stanford Univ., CA (USA). Knowledge Systems Lab.
Expert systems on multiprocessor architectures. Phase 1. Final report, March 1985-July 1987, 14:37795 (R;US)

Stanley Associates Engineering Ltd., Edmonton, AB (Canada)
Handling and disposal of waste drilling fluids from on-land sumps in the Northwest Territories and Yukon, 14:35660 (R;CA)

State Univ. of New York, Buffalo, NY (USA). Dept. of Chemical Engineering
Fundamental research on surface science of coal in support of physical beneficiation of coal: Quarterly technical progress report, January 1–March 31, 1989, 14:35551 (R;US)

Statens Energiverk, Stockholm (Sweden)
Modelling of sulphur dioxide capture in fluidized bed combustion, 14:35593 (R;SE)
Modelling of sulphur dioxide capture in fluidized bed combustion, 14:35594 (R;SE)

Statistics Canada, Ottawa, ON (Canada). Social and Economical Studies Div.
Energy typologies. Energy expenditures of Canadians, 1969-1982, 14:36231 (R;CA;In French)

Statistics Canada, Ottawa, ON (Canada). Structural Analysis Div.
Energy analysis of Canadian external trade, 1971 and 1976, 14:36227 (R;CA;In English and French)

Steel Construction Inst., Ascot (UK)
Generic steel designs for tidal power barrages. V. 1, pt. 1, 14:35950 (R;GB)
Generic steel designs for tidal power barrages. V. 1, pt. 2, 14:35951 (R;GB)

Strasbourg-1 Univ., 67 (France)
Direct photon and π^0 production by deep inelastic scattering of real photons inclusive and exclusive studies, 14:37547 (R;FR;In French)
Origin of the $^{13}C + {}^{17}O$ resonant structure, 14:37576 (R;FR)

Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires
Beam transmission in MP equipment. New measurements. Main effects and application to VIVITRON, 14:37071 (R;FR;In French)
Dipole octupole correlations in a boson model and evidence for their existence in nuclei, 14:37631 (R;SU)
Direct photon and π^0 production by deep inelastic scattering of real photons inclusive and exclusive studies, 14:37547 (R;FR;In French)
Fast-fission component with small mass drift in the reaction $^{84}Kr + {}^{27}Al$ at E_{Lab} = 5.9 MeV/u, 14:37587 (R;FR)

Neutron emission and nuclear spin distribution in 4n and 5n exit channels of the ^{156}Dy compound nucleus, 14:37586 (R;FR)
Origin of the $^{13}C + ^{17}O$ resonant structure, 14:37576 (R;FR)
Ring imaging Cherenkov detector. The DELPHI Barrel RICH Prototype. Part B: Experimental studies of the detector performance for particle identification, 14:37101 (R;FR)
Transition between phenomena governed by the mean field and those governed by nucleon-nucleon collisions in the reaction $^{40}Ar + ^{68}Zn$, 14:37580 (R;FR;In French)

Studsvik Energiteknik AB, Nykoeping (Sweden)
Base irradiation history and interim inspection of the KWU/CE test fuel rods of rod groups PK 1 and PK 2: The Studsvik Super-Ramp Project, 14:36013 (R;SE)
Base irradiation history and interim inspection of the BWR test fuel rods of rod group BK7: The Studsvik Super-Ramp Project, 14:35997 (R;SE)
Fabrication, pre-irradiation characterization and irradiation history of GE rods, for The Super-Ramp Project: The Studsvik Super-Ramp Project, 14:35998 (R;SE)
Non-destructive examinations of PW 5 rods: The Studsvik Super-Ramp Project, 14:36093 (R;SE)
Test fuel rod fabrication and pre-irradiation characterization report, rod groups PK1, PK2 and BK7: Studsvik Super-Ramp Project, 14:35996 (R;SE)
The Studsvik Super-Ramp Project: Quarterly progress report, April–June, 1982, 14:35999 (R;SE)
The Studsvik Super-Ramp Project: Quarterly progress report, July–September, 1982, 14:36000 (R;SE)

Studsvik Nuclear, Nykoeping (Sweden)
Rod overpressure experiment (ROPE). Pre-project, 14:35995 (R;SE)

Supply and Services Canada, Fredericton, NB (Canada). Information Systems Div.
Proceedings from the fifth information systems technology conference, 14:37823 (R;CA)

Surrey Univ., Guildford (UK) . Energy Economics Centre
Energy privatisation, 14:36271 (R;GB)

Sverdrup Technology, Inc., Cleveland, OH (USA)
NASA Lewis Stirling engine computer code evaluation, 14:36448 (R;US)

Swedish Council for Building Research, Stockholm (Sweden)
Conversion of detached houses with direct electric heating to district heating, 14:36374 (R;SE;In Swedish)
Uppsala heat pump. Evaluation of a district heating heatpump abstracting heat from sewage effluents, 14:36421 (R;SE;In Swedish)

Swedish Inst. of Space Physics, Kiruna (Sweden)
Investigations of auroral dynamics: techniques and results, 14:37453 (R;SE)
Scientific results from the Swedish Viking satellite: A 1988 status report, 14:37454 (R;SE)

Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden)
Postglacial faulting and paleoseismicity in the Landsjaerv area, northern Sweden, 14:37414 (R;SE)

Swedish Nuclear Power Inspectorate, Stockholm (Sweden)
Influence of spatial discretization in 3D groundwater flow calculations using the finite-element method, 14:37248 (R;SE)

T

Taratec Corp., Columbus, OH (USA)
Combustion research opportunities for industrial applications: Phase II, 14:36412 (R;US)

Technical Development Corp., Boston, MA (USA)
Business guide to energy performance contracting. Final report, 14:36392 (R;US)

Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen
Behaviour of secondary and trace elements during coal gasification in an iron bath, 14:35534 (R;DE;In German)
Mass spectrometry for investigations into the system lead/oxygen, using the electrochemical Knudsen cell, 14:36743 (R;DE;In German)

Technische Univ. Berlin (Germany, F.R.). Fachbereich Landschaftsentwicklung
Investigation about the usefulness of Landsat 5 thematic mapper data for mapping forest disease, 14:37160 (R;DE;In German)

Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Inst. fuer Geophysik
Formation and development of deposits in salt strata. Final report, 14:35598 (R;DE;In German)

TECOGEN, Inc., Waltham, MA (USA)
Open cycle heat pump development: Phase II, District heating case study analysis: Progress report, October 1988–December 31, 1988, 14:36424 (R;US)

Teknologiraadets Styregruppe for Vedvarende Energi, Copenhagen (Denmark)
Decentral dual-purpose power plants, 14:36344 (R;DK;In Danish)

Tel Aviv Univ. (Israel)
$^{230}Th/^{234}U$ dating of the quaternary spring travertines in the Arava Rift Valley of Israel and paleoclimatic implications. Final report for the period 15 December 1986 - 15 December 1987, 14:37405 (R;XA)

Tennessee Valley Authority, Chattanooga, TN (USA). Div. of Energy Demonstrations and Technology
10-MW spray dryer/ESP pilot plant test program: High-sulfur coal test phase (phase 3): Final report, 14:35962 (R;US)

Tennessee Valley Authority, Chattanooga, TN (USA). Power Business Operations/Research and Development
High-sulfur spray dryer Shawnee test program: Characterization of 10-MW spray-dryer electrostatic precipitator by-product: Final report, 14:35963 (R;US)

Tennessee Valley Authority, Chattanooga, TN (USA). Radiological Control
Annual radiological environmental monitoring report, Watts Bar Nuclear Plant, 14:37229 (R;US)
Annual radiological environmental operating report, Sequoyah Nuclear Plant, 1988, 14:37230 (R;US)
Annual radiological environmental operating report, Browns Ferry Nuclear Plant, 1988, 14:37231 (R;US)
Environmental radioactivity levels Bellefonte Nuclear Plant: Annual report, 1988, 14:37232 (R;US)

Tennessee Valley Authority, Chattanooga, TN (USA). River Basin Operations/Water Resources
Plankton studies at Sequoyah Nuclear Plant in 1988, 14:36111 (R;US)

Tennessee Valley Authority, Chattanooga, TN (USA). Water Quality Dept.
Pilot program for water quality data collection by volunteers, 14:35898 (R;US)

Tennessee Valley Authority, Knoxville, TN (USA)
Office of the Inspector General: Semiannual report, October 1, 1988–March 31, 1989, 14:37793 (R;US)
Transportation rate services, 14:36410 (R;US)

Tennessee Valley Authority, Knoxville, TN (USA). Environmental Quality Staff
Development of dredged ash disposal area: Johnsonville Fossil Plant: Final environmental assessment, 14:35564 (R;US)

Tennessee Valley Authority, Knoxville, TN (USA). Water Quality Dept.
Measurement of upwelling flow from Upper Bear Creek reservoir air diffusers, 14:35899 (R;US)

Tennessee Valley Authority, Norris, TN (USA). Aquatic Biology Dept.
Results of fisheries investigations in Douglas tailwater, August 1987–September 1988, 14:35897 (R;US)

Terra Tek, Inc., Salt Lake City, UT (USA)
Fracture-height growth containment using low-permeability bridging agents to stimulate tight gas sands with weak barriers. Topical report, January 1982-March 1985, 14:35680 (R;US)

Texas Accelerator Center, The Woodlands, TX (USA)
A compact x-ray lithography lattice using superferric magnets, 14:37034 (R;US)

An optimized H^- magnetron ion source/lebt system, 14:37073 (R;US)
The beam tracking during the first few milliseconds of a low energy booster, 14:37048 (R;US)

Texas Tech Univ., Lubbock, TX (USA). Dept. of Chemistry and Biochemistry
Novel approaches to ionic chromatography: Progress report, December 1, 1987–June 30, 1989, 14:36707 (R;US)

Texas Univ., Austin, TX (USA)
Consolidation of powders of the oxide superconductor YBa_2Cu_3Ox by high energy-high rate processing, 14:36611 (R;US)

Texas Univ., Austin, TX (USA). Dept. of Aerospace Engineering and Engineering Mechanics
Computational fluid dynamics (CFD): element-by-element analysis for advanced computers. Final report, 1 April 1987-14 November 1988, 14:37479 (R;US)

Texas Univ., Houston, TX (USA)
Application of novel material in crystal accelerator concepts, 14:37049 (R;US)

Texas Univ., Houston, TX (USA). Dept. of Physics
Comparison of analytical and computational estimates of reduction in linear aperture in the presence of sextupole field, 14:37047 (R;US)

Therma-Wave, Inc., Fremont, CA (USA)
Thermal conductivity anisotropy in single crystal $YBa_2Cu_3O_{7-x}$, 14:36616 (R;US)

Thermocube, Inc., Longueuil, PQ (Canada)
Rural and native housing demonstration program. Report and construction manual, 14:36398 (R;CA)

Thie (J.A.), Knoxville, TN (USA)
Surveillance of instrumentation channels at nuclear power plants: Volume 2, An approach to classifying problems and solutions: Final report, 14:36095 (R;US)

TIR Systems Ltd., Burnaby, BC (Canada)
Large scale illumination using prism light guide and a Vortek lamp, 14:36399 (R;CA)

Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study
Charge screening in gauge theories at finite temperature and density, 14:37551 (R;JP)
Compactification of space-time in SU(∞) Yang-Mills theory, 14:37525 (R;JP)
Super-hypernuclei in the quark-shell model, 14:37524 (R;JP)

Toshiba Corp., Tokyo (Japan). Principal Office
Super high-speed magnetically levitated system approaches: practical use, 14:36404 (R;JP)

TRW Defense and Space Systems Group, Redondo Beach, CA (USA). Applied Technology Div.
MHD Integrated Topping Cycle Project: Third quarterly progress report, 1 February–30 April 1988, 14:36347 (R;US)

TRW Space and Technology Group, Redondo Beach, CA (USA)
MHD Integrated Topping Cycle Project: Quarterly progress report, 30 September–31 October 1987, 14:36346 (R;US)

TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div.
MHD [Magnetohydrodynamics] Integrated Topping Cycle Project: Second quarterly technical progress report, November 1, 1987–January 31, 1988, 14:36348 (R;US)

U

UKAEA Harwell Lab. (UK). Chemistry Div.
Compressive creep in nuclear oxides, 14:36614 (R;GB)
High-dose intercomparison study involving red 4034 perspex and radiochromic dye films, 14:37100 (R;GB)
Sorption of radionuclides on London clay, 14:37224 (R;GB)

UKAEA Harwell Lab. (UK). Energy Technology Div.
Generic steel designs for tidal power barrages. V. 1, pt. 1, 14:35950 (R;GB)
Generic steel designs for tidal power barrages. V. 1, pt. 2, 14:35951 (R;GB)
Prediction of post barrage densities of shorebirds. V. 4. Birds, 14:35945 (R;GB)
Prediction of post barrage densities of shorebirds. V. 3. Invertebrates, 14:35946 (R;GB)
Prediction of post barrage densities of shorebirds. V. 1. Overview, 14:35947 (R;GB)
Wader migration and distribution in South West estuaries. V. 2. Appendices, 14:35944 (R;GB)
Wader migration and distribution in South West estuaries (in relation to the Severn Barrage). V. 1, 14:35948 (R;GB)

UKAEA Harwell Lab. (UK). Environmental and Medical Science Div.
Neutron spectrometry measurements with large volume cylindrical proton-recoil counters developed for use in radiological protection, 14:37099 (R;GB)

UKAEA Harwell Lab. (UK). Materials Development Div.
Mechanical degradation of polymer coated glass optical fibres under γ irradiation, 14:37128 (R;GB)

Umweltbundesamt, Berlin (Germany, F.R.)
Program to assure good in-use vehicle emissions performance in the Federal Republic of Germany through improved compliance with standards. Final report, 14:36449 (R;DE;In German)
Structural-engineering studies on the use of filter dusts from waste-incinerator flue gas cleaning as an aggregate bitumen in road construction, 14:36420 (R;DE;In German)

UNIES Ltd., Winnipeg, MB (Canada)
Basement condensation. Field study of new homes in Winnipeg, 14:36400 (R;CA)

United Technologies Research Center, East Hartford, CT (USA)
Suppression of soot in flames by alkaline-earth and other metal additives, 14:36866 (R;US)

Universidade Federal Fluminense, Niteroi, RJ (Brazil)
Controlled thermonuclear fusion in TOKAMAK type reactors, the European example: Joint European Torus (JET), 14:37763 (R;BR;In Portuguese)

Urban Consortium for Technology Initiatives (USA). Energy Task Force
Budgetary incentives for municipal energy management, 14:36425 (R;US)
Computer-assisted control for municipal water systems: Phase 1, Design for energy cost savings, 14:36427 (R;US)
Computer-assisted control for municipal water systems: Phase II, Implementation of a computer-assisted energy management program, 14:36254 (R;US)
Energy Task Force status report for first quarter year ten, 14:36253 (R;US)
Financial options for energy efficiency: A program to reduce the energy cost burden on low income residents, 14:36377 (R;US)
Inhibition of respiration in activated sludge by high carbon dioxide concentration: A laboratory study, 14:36428 (R;US)
Innovative financing plans for privately owned waste-to-energy facilities: Volume 2, User's guide, 14:36430 (R;US)
Memphis Area Rideshare on-line information system, 14:36403 (R;US)
Municipal technologies: An assessment of energy technologies for the City of Chicago, 14:36426 (R;US)
On-site municipal fuel cell power plant: Feasibility and applications guide, 14:36361 (R;US)
Retention and expansion program for high-energy use and cost-intensive business, 14:36429 (R;US)
Thermal energy storage: An application guide for local governments, 14:36197 (R;US)

USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (USA). Building Equipment Div.
Bibliography of the DOE building equipment research program, 14:36376 (R;US)

USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Quality Programs
Proceedings of the DOE quality conference: Managing for quality in a changing environment, 14:37787 (R;US)

USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of the Deputy Assistant Secretary for Oil, Gas, Shale and Special Technologies
Tar sands program plan, FY 1989, 14:35692 (R;US)
Unconventional gas recovery program plan, FY 1989, 14:35667 (R;US)

Underground coal gasification program plan, FY 1989, 14:35522 (R;US)

USDOE Energy Information Administration, Washington, DC (USA)
Documentation for the State Energy Data System 1960–1987 diskettes, 14:36341 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use
Assumptions for the annual energy outlook 1989, 14:36256 (R;US)
International petroleum statistics report, 14:35653 (R;US)
Monthly energy review, March 1989, 14:35648 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas
Annual outlook for oil and gas 1989, 14:35652 (R;US)
Natural gas monthly: April 1989, 14:35674 (R;US)
Petroleum supply annual 1988: Volume 1, 14:35651 (R;US)
Petroleum supply monthly, April 1989: Final 1988 statistics in summary section, 14:35650 (R;US)
Petroleum supply monthly, March 1989, 14:35649 (R;US)
Refinery yield model spreadsheet system (RYMSS) documentation, 14:35640 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas Statistics
International oil and gas exploration and development activities: Quarterly report, First quarter 1989, 14:35601 (R;US)

USDOE Idaho Operations Office, Idaho Falls, ID (USA)
Combustion research opportunities for industrial applications: Phase II, 14:36412 (R;US)

USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA)
MRS system study summary report, 14:35783 (R;US)
Quarterly report on program cost and schedule: First quarter FY 1989, 14:35782 (R;US)

USDOE Office of Inspector General, Washington, DC (USA)
Office of Inspector General semiannual report to the Congress, October 1, 1988–March 31, 1989, 14:36269 (R;US)

USDOE Pittsburgh Energy Technology Center, PA (USA)
Structural definition of synthetic fuels, Wilsonville I, 14:35560 (R;US)

USDOE, Washington, DC (USA)
Clean Coal Technology Demonstration Program: Draft Programmatic Environmental Impact Statement, 14:35565 (R;US)

USX Corp., Monroeville, PA (USA). USS Technical Center
Measurement of static coalbed-reservoir conditions for hydraulic-fracture design. Volume 2. Final report, March 1983-December 1986, 14:35681 (R;US)

Utah Univ., Salt Lake City, UT (USA)
[Ligand intermediates in metalcatalyzed reactions]: Progress report, July 1, 1985–June 30, 1989, 14:36737 (R;US)

Utah Univ., Salt Lake City, UT (USA). Dept. of Biology
Ecophysiology and adaptation in desert shrubs: Final report, 14:37206 (R;US)

V

Vanguard Technologies, Inc., Ogden, UT (USA)
Guidelines for quality records in electronic media for nuclear facilities (NCIG-10): Final report, 14:36047 (R;US)

Varian Associates, Inc., Palo Alto, CA (USA). Varian Research Center
High-temperature superconductivity. Quarterly report No. 1 for period ending FY89, 14:36613 (R;US)

Versar, Inc., Springfield, VA (USA)
Summary report of capacity at commercial facilities. Volume 1. Summary report, 14:36435 (R;US)
Summary report of capacity at limited commercial and company-captive facilities. Volume 1. Draft report, 14:36436 (R;US)
Summary report of capacity at limited commercial and company-captive facilities. Volume 2. Draft report, 14:36437 (R;US)

Virginia Univ., Charlottesville, VA (USA). Dept. of Environmental Sciences
Trajectory analysis of nine years of precipitation chemistry in Charlottesville, Virginia: Final report, 14:37165 (R;US)

W

Warsaw Univ. (Poland)
Gas-liquid flow in dividing Tee-junctions with a horizontal inlet and different branch orientations and diameters, 14:36981 (R;DE)

Washington Metropolitan Area Transit Authority, DC (USA)
History of the negotiations of the Washington Metropolitan Area Transit Authority, 14:36408 (R;US)

Washington State Univ., Pullman, WA (USA). Dept. of Geology
Comparison of spectral data gathered from a laboratory spectrometer and TM images with and without shadow correction, 14:37404 (R;US)

Washington Univ., Seattle, WA (USA). Nuclear Physics Lab.
Superconducting booster project: [Final report], 14:37072 (R;US)

Wayne State Univ., Detroit, MI (USA)
Josephson effect research in high-temperature superconductors. Interim report, 30 September 1987-29 September 1988, 14:36609 (R;US)

West Virginia Univ., Morgantown, WV (USA). Dept. of Chemical Engineering
Deactivation of hydrotreatment catalysts used for coal liquids: Semi-annual report, 12 May 1988–11 November 1988, 14:35525 (R;US)

Western Research Inst., Laramie, WY (USA)
Development of an advanced process for drying fine coal in an inclined fluidized bed: Technical progress report for the second quarter, January 19–March 31, 1989, 14:35513 (R;US)

Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center
Solid-oxide fuel-cell technology development. Annual report, May 1, 1987-April 30, 1988, 14:36365 (R;US)

Westinghouse Hanford Co., Richland, WA (USA)
Assessment of Basalt Waste Isolation Project's borehole mud pits soils and sediments for chemical constituents: Summary report, 14:35814 (R;US)
ASTM C-26 committee and standards development, 14:35745 (R;US)
Creep-fatigue assessment methods using elastic analysis results and adjustments, 14:36588 (R;US)
Evaluation of the advanced mixed oxide fuel test FO-2 irradiated in Fast Flux Test Facility, 14:36037 (R;US)
Fast Flux Test Facility metal fuel pin fabrication, 14:35759 (R;US)
Fast Flux Test Facility passive safety reactivity feedback measurements, 14:36034 (R;US)
FFTF metal fuel pin sodium bond quality verification, 14:36036 (R;US)
Liquid effluent study project plan, 14:35815 (R;US)
Tank farm surveillance and waste status summary report for April 1989, 14:35813 (R;US)
The texture variation in extruded graphite, 14:36663 (R;US)
Thermo-plastic analysis of a bowed sodium pump shaft, 14:36035 (R;US)
Westinghouse Hanford Company 100 Areas environmental releases for 1987, 14:35812 (R;US)

Westinghouse Hanford Co., Shippingport, PA (USA)
Shippingport Station Decommissioning Project preparation of the reactor pressure vessel: Topical report, 14:35784 (R;US)

Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (USA)
Evaluation of minimum-fluidizing velocity correlations for bed particles used in fluidized-bed calcination processes, 14:35816 (R;US)

Westinghouse Materials Co. of Ohio, Cincinnati, OH (USA). Feed Materials Production Center
Implementing requirements for radiation worker training from DOE Order 5480.11, 14:35754 (R;US)

Westinghouse Savannah River Co., Aiken, SC (USA)
Experimental facilities for pyrochemical development at the Savannah River Site, 14:35817 (R;US)
Managing data from a large-scale groundwater monitoring program, 14:37255 (R;US)

Wisconsin Univ., Madison, WI (USA)
Proposed activity - Budget for research in high energy physics: Technical progress report, January 1, 1990–December 31, 1994, 14:37491 (R;US)

Wisconsin Univ., Madison, WI (USA). Dept. of Electrical and Computer Engineering
Electromagnetic transients program (EMTP): Volume 3, Workbook III: Final report, 14:35954 (R;US)

Wuerzburg Univ. (Germany, F.R.). Medizinische Fakultaet
Radiation injuries of the intestine, treated in the Surgical Department of Wuerzburg University Hospital between 1974 and 1982, 14:37355 (R;DE;In German)
UW 21/123 monoclonal antibody in the radioimmunological detection of tumour tissue in the head and neck region, 14:37318 (R;DE;In German)

Y

Yale Univ., New Haven, CT (USA). Dept. of Computer Science
CFD (computational fluid dynamics) research for mini-supercomputers: a Yale/UTRC program. Final report, 15 February 1987-14 October 1988, 14:37478 (R;US)

Z

Zenon Environmental, Inc., Burlington, ON (Canada)
Review of environmental monitoring equipment for air, water and soil systems. Vol. 2(iii)-Equipment data sheets. Record #529-586, user and utility information records, 14:35964 (R;CA)
Review of environmental monitoring equipment for air, water and soil systems. Vol 2(ii)-Equipment data sheets. Record #247-528, 14:35965 (R;CA)
Review of environmental monitoring equipment for air water and soil systems. Vol. 2-Environmental monitoring equipment database, 14:35966 (R;CA)
Review of environmental monitoring equipment for air, water and soil systems. Vol. 1 - Instrument review, 14:35967 (R;CA)

Personal Author Index

Authors' surnames are indexed in the form appearing in the publication cited; given names generally have been reduced to initials. For documents with multiple authors, each author name is indexed. The entry for a primary author (first author listed on an abstracted document) includes the full document title and citation number. Entries for other authors provide a cross-reference to the primary author. Also included is information on the document type, country of publication, and the document language listed in parentheses in the format (J;FR;In French and English). Accent marks are not input because of computer alphabetization. Spelling and transliteration follow standard conventions.

A

Abbott, L.F., *See* Kirsch, L.E., 14:37494

Abbott, R.E., Options for broadcasting price & information, 14:36299 (RA;US)

Abbott, T., Survey of results from Brookhaven Experiment 802 at the AGS, 14:37596 (R;US)

Abdollal, K., Water treeing as a function of moisture present in XLPE cable insulation, 14:35968 (R;CA)

Abdullaev, Kh.Sh., *See* Trukhanov, G.Ya., 14:36080

Abe, K., Elastic scattering of muon-neutrinos and muon-antineutrinos by electrons, 14:37499 (R;US)

Abe, Yoshihiko, *See* Matsuura, Kiyokata, 14:37804

Abedin-Zadeh, R., *See* Menlove, H.O., 14:35757

Abegg, R., *See* Watson, J. W., 14:37579

Abele, C.C., *See* Eden, J.G., 14:36968

Abercrombie, J.S., Using computer-based training to facilitate radiation protection review, 14:35824 (RA;US)

Aberg, S., On the feeding and spectroscopy of superdeformed states, 14:37635 (R;SE)

Abrahamson, S., Health effects models for nuclear power plant accident consequence analysis: Low LET radiation: Part 2, Scientific bases for health effects models, 14:37380 (R;US)

Abramovich, S.N., *See* Zvenigorodskij, A.G., 14:37610

Abyhammar, T., *See* Nordell, B., 14:36201

Achard, M.H., *See* Grosman, A., 14:37760

Acton, D.S., Study of fine-scale solar dynamics. Final report, 6 September 1985-31 October 1988, 14:37423 (R;US)

Adair, J., New solutions to oil problems in pumping heavy oil, 14:35620 (RA;CA)

Adams, R.G., *See* Raymond, T.D., 14:36972

Adams, R.L., *See* White, B.A., 14:36237

Adamson, B., *See* Levine, M.D., 14:36384

Addison, J., Release of dispersed asbestos fibres from soils, 14:37190 (R;GB)

Adelman, K.L., Impact upon US security of a South African nuclear-weapons capability. Final technical report, 14:36458 (R;US)

Adler, V., Chemical and nuclear emergencies: Interchanging lessons learned from planning and accident experience, 14:37344 (R;US)

Adolphsen, C., An alignment method for the Mark II silicon strip vertex detector using an x-ray beam, 14:37096 (R;US)

Adusumilli, M.S., Mineralogy of bismutotanitalite from Northeastern. Brazil, 14:37210 (R;BR;In Portuguese)

Afnan, I. R., *See* Pearce, B. C., 14:37537

Agranat, V.Z., On incompleteness of interpretation rules for some diagnostic images, 14:37319 (RA;SU;In Russian)

Agrawal, D.P., *See* Janakiram, V.K., 14:37794

Agrawal, R.C., Seismic zoning in India, 14:37408 (R;XA)

Aguilar, M., *See* Figuerola, E., 14:36840

Ahn, B.T., Phase relations in quaternary copper oxide electrodes, 14:36652 (BA;US)

Ahrens, L.A., *See* Abe, K., 14:37499

Aiche, M., *See* Mikhajlov, I.N., 14:37631

Aikin, R.M., *See* Maley, M.P., 14:36945

Ait-Boubker, S., Thermal neutron detection with a lithium-6 loaded liquid scintillator, 14:37114 (R;FR)

Ajzatskij, N.I., Effect of high-frequency energy recuperation on the intense electron beam acceleration dynamics, 14:37055 (RA;SU;In Russian)

Akan-Etuk, Nniefiok, Pyrite thermochemistry, ash agglomeration, and char fragmentation during pulverized coal combustion: Quarterly report, December 15, 1988–March 15, 1989, 14:35583 (R;US)

Akchagirov, B.B., Surface tension of alkali metals and alloys, 14:36555 (RA;SU;In Russian)

Akers, D.W., TMI-2 core debris analytical methods and results, 14:36191 (BA;US)

See Vinjamuri, K., 14:36192

Akhekyan, A.M., Clasterization of isoelectronic tellurium addition in $ZnS_{1-x}Te_x$ solid solution, 14:37681 (RA;SU;In Russian)

Akhmatova, Zh.T., Effect of cesium ions on character of solubility and rare earth formate complexing processes, 14:36778 (RA;SU;In Russian)

Akiba, Y., *See* Abbott, T., 14:37596

Akiya, T., Study of cool storage using refrigerant gas hydrate, 14:36216 (RA;CA;In English and French)

Akopov, E.K., Thermographic and X-ray diffraction study of binary systems based on rare alkali metal and thallium (1) nitrates and conditions of solid solution formation in them, 14:36787 (RA;SU;In Russian)

Al Rabah, A.K., Performance of first and second pilot cyclic steam stimulation projects in Kuwait, 14:35612 (RA;CA)

Al-Ayat, R.A., *See* Matter, J.C., 14:35850

Alami, R., *See* Rivet, M.F., 14:37578

Alarja, J., *See* Drain, D., 14:37116

Albert, C., *See* Bottcher, C., 14:37498

Albinsson, Y., Complex formation of lanthanide(111) with acetylacetone studied by the akufve-lison technique, 14:36827 (RA;SU)

Albrecht, R., *See* Awes, T.C., 14:37562

See Plasil, F., 14:37597

Albuquerque Menor, E. de, Mineralogical behavior of the phosphatic sedimentation in Pernambuco-Paraiba sedimentar coastal basin, 14:37209 (R;BR;In Portuguese)

Alburger, D., *See* Abbott, T., 14:37596

Alcorn, J., A superconducting dipole concept for the CEBAF high resolution spectrometers, 14:36943 (J;US)

See Brindza, P., 14:36934

See O'Meara, J., 14:36942

See Tuzel, W., 14:36937

Alekhin, S.I., High-energy physics. Panorama of programs. Description of the problem situation, 14:37518 (R;SU;In Russian)

Alekperov, E.R., Extractants for boron, 14:36836 (RA;SU)

Aleksan, R., *See* Ait-Boubker, S., 14:37114

Alekseeva, V.A., Doses of occupational irradiation of medical personnel of the RSFSR, 14:37653 (RA;SU;In Russian)

Alenichkin, A.S., *See* Anisimov, V.V., 14:36564

Alfano, R.R., *See* Petricevic, V., 14:36959

Alford, W. P., *See* Watson, J. W., 14:37579

Alford, W.J., *See* Smith, A.V., 14:36974

Alian, A., Activation analysis of air particulate matter, 14:36720 (R;DE)

Alisejchik, V.V., *See* Banik, V.V., 14:36808

See Blank, A.B., 14:36712

Alkire, R.C., *See* Clerc, C., 14:36367
Allakhverdov, G.R., *See* Belov, V.V., 14:36776
See Ryabenko, E.A., 14:36805
Allen, B.J., *See* Brown, J.K., 14:37350
Allen, B.L., General economic stimulation and energy indicators for capital investment initiatives in various transportation modes, 14:36229 (R;CA)
Allen, D.T., Continuous thermodynamics and group contribution methods for coal liquids: Final report, October 1, 1986–October 1, 1989, 14:35558 (R;US)
Allen, G., Integrated thermal storage in energy systems for Canadian low energy houses, 14:36383 (RA;CA;In English and French)
Allen, M.R., HIFAR refurbishing program, 14:36148 (RA;AU)
Alley, G.T., *See* Britton, C.L. Jr., 14:37000
Allison, P., *See* Sherman, J., 14:37089
Allred, J.F., *See* Knapp, F.F. Jr., 14:37320
Alper, J.M., History of the negotiations of the Washington Metropolitan Area Transit Authority, 14:36408 (R;US)
Alpert, D.J., *See* Spulak, R.G. Jr., 14:36195
Alsmiller, F.S., Inclusion of correlations in the empirical selection of intranuclear cascade nucleons from high energy hadron-nucleus collisions, 14:37127 (J;NL)
Alsmiller, R.G. Jr., *See* Alsmiller, F.S., 14:37127
Altenhofen, M.K., An evaluation of near-field host rock temperatures for a spent fuel repository, 14:35805 (R;US)
Althaus, R.F., *See* Gilbert, W.S., 14:36913
Alton, G.D., A high-intensity plasma-sputter heavy negative ion source, 14:37467 (R;US)
See Read, P.M., 14:37466
Alvarado, F.L., Electromagnetic transients program (EMTP): Volume 3, Workbook III: Final report, 14:35954 (R;US)
Alwast, N.K., *See* Rottenfuss, B.A., 14:35698
Amako, K., *See* Abe, K., 14:37499
Amaral, A.J.R. do, *See* Albuquerque Menor, E. de, 14:37209
Ambrose, K.R., *See* Knapp, F.F. Jr., 14:37320
Amico, P.J., *See* Prassinos, P.G., 14:36170
Amos, C.N., *See* Benjamin, A.S., 14:36177
Amosov, I.I., Test results for experimental set of powerful pulse klystrons of RF channel of the meson factory's linear accelerator, 14:37081 (RA;SU;In Russian)
AMPHORA Collaboration, *See* Drain, D., 14:37116
Anantaraman, N., *See* Marty, N., 14:37630
and others, *See* Watson, J. W., 14:37579
Anderson, A.C., *See* Lichtenwalner, D.J., 14:36465
Anderson, C.I., *See* Soo, P., 14:35794
Anderson, E., AQUIRE: Aquatic Toxicity Information Retrieval data base. Data file, 14:37275 (R;US)
Anderson, G.R., Induction of VL30 element expression as a response to anoxic stress, 14:37388 (RA;US)
Andersson, S., Ground heat technology in Sweden, 14:36200 (RA;CA;In English and French)
Ando, Y., *See* Akiya, T., 14:36216
Andreev, B.M., Catalytic properties of hydride-forming intermetallic compounds in reactions with the participation of hydrogen, 14:36814 (RA;SU;In Russian)
Andreev, V.A., Measuring RF field distribution in the 4-chamber H-resonator using microcomputer, 14:37083 (RA;SU;In Russian)
Andrews, E.M., Stretford chemistry and analytical methods handbook. Topical report, 14:35675 (R;US)
Andrews, W.H. Jr., A remote sensor/cable identifier, 14:37001 (R;US)
Anerella, M.D., *See* Goodzeit, C.L., 14:36911
Angel, S.M., High-temperature optical-fiber pH sensor: Final report, 14:36848 (R;US)
Angelov, G., Angelov/Shibley process improves economics of processing heavy oil, 14:35639 (RA;CA)
Anisimov, V.V., On the question of nonconsumable electrode measuring of temperature in the process of argon-arc welding, 14:36564 (RA;SU;In Russian)
Anne, R., Multiple angular scattering of heavy ions $^{16-17}O$, ^{40}Ar, ^{86}Kr, ^{100}Mo at intermediate energies (20-90 MeV/u), 14:37682 (R;FR)
See Herault, J., 14:37573
Anthony, D.H.J., *See* Neilson, M.A., 14:37257
Antipov, S.P., Probe measurements in the gas descharge plasma of a negative hydrogen ion source, 14:37768 (RA;SU;In Russian)
Antonenko, G.I., *See* Indyk, V.M., 14:37378, 14:37379
Antonsen, T.M. Jr., *See* Booske, J.H., 14:36961
Apanasenko, V.V., Micelle formation during extraction of alkali elements from strongly alkaline mediums, 14:36822 (RA;SU)
Appel, B.R., Southern California Air Quality Study: fall study. Final report, 14:37188 (R;US)
Appel, D.B., *See* Dreike, P.L., 14:37775
Appel, H., *See* Conell, S., 14:37677
Appelman, E.H., *See* Klaening, U.K., 14:36853
Arakelian, S.G., New results on narrow dibaryns produced in $np\text{-}pp\pi^-$ at 1.25 Gev/c, 14:37520 (RA;RO;In Romanian)
On the possilility that (7q,q-bar) resonances decay into (6q) dibaryons, 14:37521 (RA;RO;In Romanian)
Arens, J.F., *See* Kramer, G., 14:37119
Arenson, D.R., Separation of low molecular weight alcohols from dilute aqueous solutions by reversible chemical complexation, 14:36725 (R;US)
Arias, J., *See* Romero, O., 14:35616
Arkhangel'skaya, G.V., *See* Ramzaev, P.V., 14:37646
Arkhestov, R.Kh., *See* Akchagirov, B.B., 14:36555
Arkhincheeva, S.I., *See* Mokhosoev, M.V., 14:36766
Arkhipov, S.M., Preparation of cesium iodide of high purity for low-background monocrystals, 14:36806 (RA;SU;In Russian)
Armas, A., CYRO - A fault tree analysis code for personal computers, 14:35981 (RA;XA)
Armstrong, R.B., *See* Sice, H., 14:35637
Arnold, B.J., Testing of pyrite flotation techniques on selected Ohio coals: Final report, 14:35512 (R;US)
Arnold, P.B., Complete computation of high-p_T W and Z production in second-order QCD, 14:37536 (J;NL)
Arnold, R., Ring imaging Cherenkov detector. The DELPHI Barrel RICH Prototype. Part B: Experimental studies of the detector performance for particle identification, 14:37101 (R;FR)
Arnold, W., *See* Korn, D., 14:36541
Aronson, S.H., *See* Abe, K., 14:37499
Arst, M., *See* Hahn, S., 14:36694
Artamonova, E.A., *See* Ponomareva, T.V., 14:37360
Artem'ev, N.I., Technique for multigroup calculation of a two-dimensional reactor in neutron energy slowing-down and thermalization ranges with burnup accounting, 14:36074 (RA;SU;In Russian)
Artemov, V.S., Acceleration He_4^{2+} ions on the 1-2 proton linear accelerator up to the energy of 24 MeV/nucleus, 14:37036 (RA;SU;In Russian)
Arthur, W.L., *See* Rothstein, R.J., 14:37293
Ash, P.O., *See* Dusseault, M.B, 14:35738
Ashcroft, N.W., *See* Maggs, A.C., 14:37666
Ashour, S.S., *See* Rorrer, G.L., 14:35869
Askinazi, L.G., Fast current rise studied in the steady-state discharge of the Tuman-3 device, 14:37723 (RA;SU;In Russian)
Aslam, S., Asynchronous integration of ordinary differential equations on multiprocessors, 14:37802 (R;US)
Aslanov, G.A., On the ion temperature measurement by the CO_2-laser radiation scattering in tokamaks, 14:37726 (RA;SU;In Russian)
Assis, A.S. de, *See* Paris, P.J., 14:37763
Aston, T.R.C., Data compilation report: strata deformation monitoring, No. 3 TBM tunnel, Donkin-Morien mine, N.S., 14:35567 (R;CA)
The application of rock bolt design methods to a proposed 7 West crosscut, Prince Mine, Sydney Coalfield, N.S., 14:35568 (R;CA)
See Cain, P., 14:35561
See Campbell, M.J., 14:35570
Atanov, A.I., *See* Kuranov, K.E., 14:36790
Atkin, R.G., *See* Devgun, J.S., 14:37226
Attig, R.C., MHD bottoming cycle component testing at the coal fired flow facility - 1987, 14:36349 (BA;US)
Atwood, J.L., Applications of inclusion in separation science, 14:35915 (BA;US)
Aubin, J., *See* Langhame, Y., 14:35972
Auciello, O., *See* Haasz, A.A., 14:37755
Audette, L., *See* Desrochers, G., 14:35971
Auerbach, S.I., *See* Fulkerson, W., 14:36245
Aufray, B., *See* Bouchet, D., 14:36504

See Charai, A., 14:36506
Augustin, J.E., Radiative decay of J/psi into $\gamma\pi^+\pi^-$, 14:37571 (R;FR)
Augustson, R.H., *See* Menlove, H.O., 14:35757
Aurich, J., New bis(grown ether)s as extraction agents, 14:36832 (RA;SU)
Ausseur, J.Y., *See* Sauty, J.P., 14:36210
Aust, K.T., *See* Liu, D., 14:36530
See Palumbo, G., 14:36520
Autin, B., General properties of an asymmetric B-factory lattice, 14:37064 (R;US)
Avenier, M., *See* Ait-Boubker, S., 14:37114
Aver'yanova, T.K., *See* Monakhov, A.S., 14:37367
Averill, D.W., Removal of radium-226 from uranium mining effluents. Final report of a joint government-industry program, 14:35787 (R;CA)
Awadalla, N.G., *See* Sindelar, R.L., 14:36126
Awes, T.C., Transverse energy scaling and energy density estimates from ^{16}O- and ^{32}S-induced reactions, 14:37562 (R;US)
See Plasil, F., 14:37597
Ayres, J.M., Assessment of unitary cool storage systems: Final report, 14:36413 (R;US)
Azaiez, F., *See* Langevin-Joliot, H., 14:37588
Azarova, L.A., Solubility of solid phases of the system CsBr-$HgBr_2$-H_2O at 50 and 75 deg C, 14:36793 (RA;SU;In Russian)
Aziev, R.G., *See* Lazoryak, V.I., 14:36756

B

Baba, Osamu, Fission products plate-out analysis code in the HTGR: PLAIN, 14:36021 (R;JP;In Japanese)
Babkin, N.A., On an approach to NPP diagnostics automation, 14:36103 (RA;SU;In Russian)
On some methods of NPP functional diagnostics, 14:36102 (RA;SU;In Russian)
Babu, M., 5-MW Toronto HALT [Hydrate Addition at Low Temperature] pilot plant testing: Test results: Part 1-A, 14:35958 (R;US)
Bachu, S., *See* Perkins, E., 14:35739
Back, C. A., *See* Balmer, J., 14:37752
Bacon, L.D., LineCAP [Line/Circuit Analysis Program]: Cross-coupling on PC [printed circuit] board traces including discontinuities and circuit elements, 14:37015 (R;US)
See Riley, D.J., 14:35975
Badra, C., *See* Galiasso, R., 14:35704
Baeckstroem, B., *See* Wilen, P., 14:36207
Baek, Y.K., *See* Jeong, I.B., 14:36528
Bagreev, V.V., Ir, NMR and conductivity study of extracts and the character of the mutual influence of metals in their extraction with alkylammonium salts, 14:36716 (RA;SU)
Bahm, E., Investigation of the angular distribution of secondary energy dependent inelastic neutron cross sections in structural materials using Blann's geometry dependent hybrid model, 14:37619 (RA;XA)
Bailey, V.L., *See* Sanford, T.W.L., 14:37092
Baillon, P., *See* Arnold, R., 14:37101
Baker, D.A., *See* Kennedy, W.E., Jr., 14:35785
Baker, K., *See* Moore, C., 14:36162
Baker, R.B., *See* Gilpin, L.L., 14:36037
Baker, S.P., *See* Andrews, W.H. Jr., 14:37001
Baker, W.E., *See* Farrar, C.R., 14:36091
Baktash, C., *See* Awes, T.C., 14:37562
See Plasil, F., 14:37597
Balakirev, V.A., *See* Ivanov, B.I., 14:37059
Baldin, A.M., Automodel properties of baryon clusters in interactions of p-, d-, He-, C- and π^--particles with carbon nuclei within 4-40 GeV/c per nucleon momentum interval, 14:37632 (R;SU;In Russian)
Baldis, H., *See* Campbell, E.M., 14:37745
Baldova, M.V., Synthesis and physicochemical properties of ammonium-containing fluoroaluminates of rare alkali elements, 14:36786 (RA;SU;In Russian)
See Morozov, V.G., 14:36803
Baldwin, R.M., *See* Miller, R.L., 14:35641
Bale, H.D., Role of porosity in supercritical fluid extraction of coal: Technical progress report, 14:35559 (R;US)
Balfanz, H.P., Requirements and methods for a computer based information system on safety parameters and PSA for operational NPP safety management, 14:35978 (RA;XA)
Balint, A.B., Comparing personal alpha dosimetry with the conventional area monitoring-time weighting methods of exposure estimation: a Canadian assessment, 14:37641 (R;CA)
Ball, D.G., Application of probabilistic fracture mechanics to the pressurized-thermal-shock issue, 14:36168 (BA;US)
Ballester, G.E., *See* Livengood, T.A., 14:37428
See McGrath, M.A., 14:37427
Balluffi, R.W., Search for experimentally observed grain boundary phase transitions, 14:36498 (BA;FR)
See Mader, W., 14:37668
Balmer, J., X-ray absorption spectroscopy of laser-produced plasmas: A study of the experiment and data analysis, 14:37752 (J;US)
Baluev, A.V., Complexation and extraction of halogenoacetates in ternary systems salt-water-extractant, 14:36862 (RA;SU)
Bambade, P., *See* Haiessinski, J., 14:37066
See Toge, N., 14:37095
Banaschik, M., Reactor safety research results and perspectives, 14:36149 (R;DE;In German)
Band, D.L., Millimeter wavelength observations of SS 433 and its environs, 14:37446 (J;US)
Bandy, R., Role of residual stress in stress corrosion cracking in Alloy 600 tubes - Part I, 14:36592 (BA;US)
See Newman, R.C., 14:36175
Banik, V.V., Granulation from melt of cesium iodide base compositions, 14:36808 (RA;SU;In Russian)
Preparation of cesium iodide of high purity, 14:36807 (RA;SU;In Russian)
Technology of preparation of cesium chloride and iodine from CsI(Tl) monocrystal wastes, 14:36804 (RA;SU;In Russian)
Banks, G.N., Final report on the comparative combustion properties of raw and washed Prince Mine coal, 14:35588 (R;CA)
Banks, J., *See* Fedoroff, N., 14:37287
Banks, T., *See* Klebanov, I., 14:37711
Bankston, C.A., Technical and economic feasibility of central solar heating plants with seasonal storage, 14:35932 (RA;CA;In English and French)
Barale, P.J., *See* Gilbert, W.S., 14:36913
Baranov, O.V., PRECON program abstract, 14:36031 (RA;SU;In Russian)
Barashenkov, I.V., Bose gas with two- and three-particle interaction: evolution of soliton-like bubbles, 14:37703 (RA;SU;In Russian)
Barbier, F., Grain boundary diffusion of Co and Ni in bicrystalline and polycrystalline NiO, 14:36633 (BA;FR)
Barbier, G., *See* Drain, D., 14:37116
Barger, V., Proposed activity - Budget for research in high energy physics: Technical progress report, January 1, 1990–December 31, 1994, 14:37491 (R;US)
Barinaga, C.J., *See* Loo, J.A., 14:36846
See Smith, R.D., 14:37143, 14:37475
Barker, D., *See* Benczer-Koller, N., 14:37590
Barklow, T., *See* Toge, N., 14:37095
Barlo, T.J., *See* Fessler, R.R., 14:35685
Barlow, C.R., *See* Henson, H.M., 14:35777
Barmak, K., *See* Coffey, K.R., 14:36944
Barnes, F.J., Gas exchange characteristics of Pinus edulis and Juniperus monosperma, 14:35917 (J;US)
Barnes, P.D., Hyperon production with antiprotons, 14:37503 (R;US)
Report of the kaon subcommittee of nuclear science advisory committee: Final report, 14:37496 (R;US)
Strangeness production with antiprotons at LEAR, 14:37505 (R;US)
See Hertzog, D.W., 14:37504
Barnes, V., *See* Moore, C., 14:36162
Barnett, B., *See* Adolphsen, C., 14:37096
Baron, P.A., *See* Geraci, C.L., 14:37180
Barrett, J.H., High-dose intercomparison study involving red 4034 perspex and radiochromic dye films, 14:37100 (R;GB)
See Marwick, A.D., 14:36695

Barron, K.R.P., Development of HPLC techniques for the analysis of trace-metal species in the primary coolant of a pressurized-water reactor, 14:36015 (D;GB)
Barsegov, D.G., *See* Il'yasov, I.I., 14:36791
Barsukov, A.B., Correction of field distribution in an H-wave weakly irregular accelerating structure, 14:37054 (R;SU;In Russian)
Quasistatic model of H-wave accelerating structures, 14:37053 (R;SU;In Russian)
Bartel, J.J., *See* LaJeunesse, C.A., 14:36884
Bartel, T.J., Energy accommodation modeling of rarefied flow over re-entry vehicle geometries using DSMC [Direct Simulation Monte Carlo], 14:36409 (R;US)
Bartell, S.M., *See* Blaylock, B.G., 14:37661
Barter, C., Neural networks, D0, and the SSC, 14:37104 (R;US)
Bartolini, C., *See* Giovannelli, F., 14:37434
Barton, B.D., An Auger sputter profiling study of nitrogen and oxygen ion implantation in two titanium alloys, 14:37688 (R;US)
Barton, R., *See* Missert, N., 14:36955
Bartsch, R.A., *See* Walkowiak, W., 14:36834
Bartsch, R.R., *See* Cochrane, J.C., 14:37686
Bary, A., EBIC and DLTS measurements of SI- and polycrystalline silicon, 14:36673 (BA;FR)
Basalaeva, L.N., On thorium and plutonium cocrystallization with calcium oxalate, 14:37356 (RA;SU;In Russian)
Baskes, M.I., Application of the embedded atom method to the fracture of interfaces, 14:36514 (BA;FR)
Basovich, O.M., *See* Khajkina, E.G., 14:36767
Basrak, Z., *See* Freeman, R.M., 14:37576
Bassi, J., Summary report of capacity at commercial facilities. Volume 1. Summary report, 14:36435 (R;US)
Summary report of capacity at limited commercial and company-captive facilities. Volume 1. Draft report, 14:36436 (R;US)
Summary report of capacity at limited commercial and company-captive facilities. Volume 2. Draft report, 14:36437 (R;US)
Bastin, G., *See* Bourgeois, C., 14:37591, 14:37593
See Herault, J., 14:37573
Bastin, G. Paris-11 Univ, *See* Anne, R., 14:37682
Bastl, W., Perspectives of expert systems for nuclear reactor safety, 14:36150 (R;DE;In German)
Batalin, V.A., *See* Artemov, V.S., 14:37036
Bateman, G., *See* Singer, C.E., 14:37740
Batt, D.L., Organization of Risk Analysis Codes for Living Evaluations (ORACLE), 14:36053 (BA;DE)
Batten, J.J., Corrosion of high-density sintered tungsten alloys. Part 1. Immersion testing, 14:36463 (R;AU)
Corrosion of high-density sintered tungsten alloys. Part 2. Accelerated corrosion testing, 14:36464 (R;AU)
Battye, R., *See* Kersteter, S.L., 14:37205
Batueva, I.S., Synthesis and properties of double tungstates of rubidium, cesium, and titanium, 14:36765 (RA;SU;In Russian)
Bauer, S.J., Preliminary analyses in support of in situ thermomechanical investigations, 14:35809 (R;US)
Baughman, R.J., *See* Venturini, E.L., 14:36584, 14:36647
Baum, H.P., RF electromagnetic investigation of an $YBa_2Cu_3O_7$ thin film by proximity coupling, 14:36902 (J;US)
Baum, J.W., *See* Khan, T.A., 14:36159, 14:36160
Baumann, D.D., *See* Berrens, R.P., 14:37399
Baumann, H., Radiation exposure to skin following radioactive contamination, 14:37384 (R;DD;In German)
Baumann, N.P., *See* Sindelar, R.L., 14:36126
Baumbaugh, A., *See* Ruchti, R., 14:37109
Baumbaugh, B., *See* Ruchti, R., 14:37109
Bauser, E., *See* Li, M.F., 14:36699
Bayliss, A., Bifurcation and pattern formation in combustion, 14:36867 (R;US)
Baynes, P.A., *See* Mayfield, N.E., 14:35776
Bazarova, Zh.G., *See* Batueva, I.S., 14:36765
See Mokhosoev, M.V., 14:36766
Bazyukina, M.A., Dependence of reproduction indices of female mice on their age under the effect of fractionated irradiation, 14:37358 (RA;SU;In Russian)
Beahm, E.C., Iodine volatility, 14:36186 (BA;US)
Beasley, M.R., *See* Ferrari, M.J., 14:36897
See Rosenthal, P., 14:36900
Beaulac, G., *See* Slack, M.W., 14:35627
Beavis, D., *See* Abbott, T., 14:37596
Becceneri, J.C., *See* Seehusen, J., 14:36068
Beck, F., *See* Bourgeois, C., 14:37593
Beck, F.A., *See* Bourgeois, C., 14:37591
See Vivien, J.P., 14:37586
Becker, F.E., *See* DiBella, F., 14:36424
Becker, G., *See* Balfanz, H.P., 14:35978
Beckie, K.N., Geology and resources of the primrose crude bitumen deposits northeastern Alberta, 14:35696 (RA;CA)
Beckmann, P., *See* Awes, T.C., 14:37562
See Plasil, F., 14:37597
Bedard, C., Development of air-entrained, high-strength concrete. Normal weight concrete, 14:36660 (R;CA)
Development of air-entrained, high-strength concrete. Lightweight concrete, 14:36661 (R;CA)
Bedard, N., Cyclic loading for distribution cables in duct banks, Vol. 4, 14:35970 (R;CA)
Bediaga, I., Predictions about the decays of the B-mesons, 14:37516 (R;BR)
Beer, J.M., *See* Yu, T.U., 14:35581
Beery, J.G., *See* Raistrick, I.D., 14:37021
Beese, L., *See* Steitz, T.A., 14:37297
Begay, F., *See* Cochrane, J.C., 14:37686
Begemann, M., *See* Weinstein, I.B., 14:37389
Begonia, G., *See* Garrett, H.E., 14:35901
Behmanesh, N., *See* Allen, D.T., 14:35558
Beier, E.W., *See* Abe, K., 14:37499
Beiersdorfer, P., Atomic physics studies of highly charged ions on tokamaks using x-ray spectroscopy, 14:37738 (R;US)
Bejder, B.D., Installation for semiautomatic air-plasma metal cutting up to 6 mm thickness, 14:36563 (RA;SU;In Russian)
Bekyasheva, T.A., *See* Basalaeva, L.N., 14:37356
Belavkin, V.P., Quantum random processes and kinetic equations of multi-quantum systems, 14:37704 (RA;SU)
Belej, A.S., Reconstruction project for accelerating structure of small-size deuteron linear accelerator, 14:37037 (RA;SU;In Russian)
Belfort, G., Wood sugars to energy-intensive organic chemicals: Phase 1. Final report, 14:35858 (R;US)
Belikov, V.V., Electron injector for high-voltage model of collective accelerator, 14:37078 (RA;SU;In Russian)
Bell, D.D., *See* MacGillivray, J.R., 14:35699
Bell, Z.W., *See* Marshall, B.B., 14:37121
Belloni, T., *See* Treves, A., 14:37431
Belousov, A.N., New generation of welded semiautomatic for production of structures out of steels and aluminium alloys, 14:36566 (RA;SU;In Russian)
Belov, V.V., Features of solid-phase interaction between lithium carbonate and niobium pentoxide hydrate, 14:36776 (RA;SU;In Russian)
Belyaev, V.I., *See* Andreev, V.A., 14:37083
Belzer, D.B., *See* Serot, D.E., 14:35654
Benaroya, R., *See* Shepard, K.W., 14:37069
Benchakroun, A., A planning model for electrical power distribution grids, 14:35973 (R;CA;In French)
Benczer-Koller, N., Magnetic moments of low-lying states in ^{103}Rh, $^{111,113}Cd$, and $^{123,125}Te$, 14:37590 (J;US)
Bender, M., *See* Abrahamson, S., 14:37380
Benecke, M.W., Fast Flux Test Facility metal fuel pin fabrication, 14:35759 (R;US)
Benet, P., *See* Vivien, J.P., 14:37586
Beninga, K., An improved design for stretched-membrane heliostats, 14:35926 (R;US)
Beninson, D., Optimization of radiation protection, 14:35832 (RA;CA)
Benjamin, A.S., NUREG-1150 risk assessment methodology and results, 14:36177 (BA;DE)
Benjegerdes, R.W., *See* Gilbert, W.S., 14:36913
Bennett, G.A., *See* Briles, S.D., 14:37137
Bennett, J.G., *See* Farrar, C.R., 14:36091
Bennett, P.C., Investigation of cask contamination weeping: A progress report, 14:36888 (R;US)
Bensinger, J.R., *See* Kirsch, L.E., 14:37494
Bentley, J., *See* Reucroft, P.J., 14:36482

Beraha, D., Nuclear plant analyser, a tool for evaluating actions of accident management, 14:36153 (R;DE;In German)
Beraud, R., *See* Genevey, J., 14:37581
Berdichevsky, D., *See* Benczer-Koller, N., 14:37590
Berezniuk, T., *See* Keith, D.A.W, 14:35694
See MacGillivray, J.R., 14:35699
Berg, U., RELTREE - A PC program for fault tree construction, documentation and analysis, 14:35982 (RA;XA)
Bergenlid, U., Non-destructive examinations of PW 5 rods: The Studsvik Super-Ramp Project, 14:36093 (R;SE)
Berger, F., *See* Awes, T.C., 14:37562
See Plasil, F., 14:37597
Berggren, M.H., *See* Boysen, J.E., 14:35513
Bergman, C.D., *See* Mason, R.J., 14:37806
Bergshoeff, E., Compactifications of the eleven-dimensional supermembrane, 14:37700 (R;XA)
Bergstroem, S., Experience from integated simulations of runoff, water quality and residence time. International symposium on acidification and water pathways, 14:37264 (RA;NO)
Berhane, H., *See* Keith, D.A.W, 14:35694
See MacGillivray, J.R., 14:35699
Berman, C.H., Enhanced flame stability and soot radiation using electric fields. Annual report, July 1987-July 1988, 14:35687 (R;US)
Berner, T., Photoadaptation and the package effect in Dunaliella tertiolecta (Chlorophyceae), 14:37253 (J;US)
Bernhard, S., Identification of nonuranium mines which present a radon risk through measurements of exhaust air, 14:35834 (RA;CA)
Berntsson, T., *See* Franck, P.A., 14:36382
Berrada, M., Measure of back angle cross sections of antiproton-nucleus elastic scattering at 48 and 180 MeV, 14:37577 (R;FR;In French)
Berrens, R.P., Examination of noise-management approaches in the United States. Final report, 14:37399 (R;US)
Berry, J.A., Sorption of radionuclides on London clay, 14:37224 (R;GB)
Berz, M., *See* Forest, E., 14:37709
Besch, H.J., *See* Arnold, R., 14:37101
Besenbacher, F., *See* Myers, S.M., 14:36606
Beskid, N.J., *See* Devgun, J.S., 14:37226
Besliu, C., Cumulative π^- production in 4.5 AGeV/c He induced reactions, 14:37519 (RA;RO;In Romanian)
See Arakelian, S.G., 14:37520, 14:37521
Besson, P., *See* Ait-Boubker, S., 14:37114
Best, D.A., *See* Edmunds, N.R., 14:35708
Betz, T.L., Developing a performance based retraining program for the advanced test reactor (ATR) reactor operators and supervisors, 14:36113 (RA;US)
Beyer, J.B., *See* Martens, J.S., 14:36898, 14:36901, 14:36904
Beyerlein, S.W., *See* Jacobsen, R.T., 14:35686
Beyerman, G.A., *See* Simons, C.A., 14:35865
Beyermann, M., *See* Baumann, H., 14:37384
Beyler, W.E., *See* Bonano, E.J., 14:35792
Bharuth-Ram, K., *See* Conell, S., 14:37677
Bhattacharyya, A.T., *See* Niessen, H.F., 14:36024
Bianchi, L., IUE and optical observations of X-ray sources in the LMC, 14:37435 (RA;FR)
Biberhofer, J., *See* Neilson, M.A., 14:37257
Bibl, K., *See* Reinisch, B.W., 14:37452
Bidwell, M.O., Efficiency vs. fairness retail pricing, 14:36310 (RA;US)
Bieg, K.W., *See* McKay, P.F., 14:37776
See Stinnett, R.W., 14:37780
Bielecki, A., *See* Fan, N.Q., 14:36905
Bigu, J., Removal of airborne thoron (radon) daughters on mine walls and other surfaces by convective deposition and electrostatic plate-out, 14:35833 (RA;CA)
Billerey, R., *See* Drain, D., 14:37116
Billings, H.C., *See* Hajek, B.K., 14:35755
Bimbot, R., Production of 400 MeV/u radioactive ion beams for therapy purposes, 14:37574 (R;FR)
See Anne, R., 14:37682
See Herault, J., 14:37573
Bingham, B., *See* Snell, M., 14:35849
Bingham, P.M., Transposons as probes of regulatory machinery, 14:37291 (RA;US)
Birath, S., *See* Bergenlid, U., 14:36093
Birch, R., *See* Delafield, H.J., 14:37099
Birlen, P., *See* Barnes, P.D., 14:37503, 14:37505
See Hertzog, D.W., 14:37504
Birkmire, R.W., Materials analysis and device optimization of $CuInSe_2$ solar cells: Annual subcontract report, 16 January 1987–15 January 1988, 14:35913 (R;US)
Two-terminal $CuInSe_2$-based cascade cells: Annual subcontract report, 16 January 1987–15 January 1988, 14:35911 (R;US)
Birks, N., Coal ash deposition, interaction with metal substrates and deposit build up: Summary report, 26 February 1989–25 May 1989, 14:35586 (R;US)
Birn, J., *See* Hesse, M., 14:37455
Birnbaum, H.K., Hydrogen segregation and diffusion at grain boundaries, 14:36501 (BA;FR)
See Ladna, B., 14:36508
See Robertson, I.M., 14:36533
Birringer, R., *See* Korn, D., 14:36541
Biryuk, G.I., GABI program abstract, 14:36030 (RA;SU;In Russian)
Biscondi, M., *See* Nowicki, T.N., 14:36502, 14:36503
Bishop, A.R., Competing interactions and complexity in condensed matter, 14:37687 (R;US)
Bitter, M., *See* Beiersdorfer, P., 14:37738
Bivered, B., *See* Bergenlid, U., 14:36093
Biwer, B.M., *See* Schauer, M.W., 14:36650
Bjoerkqvist, D., Liming as a method to neutralize highly acidic drainage waters from sulphate basins in western Finland, 14:37247 (RA;NO)
Bjoernstad, H.E., *See* Lydersen, E., 14:37263
Bjornn, K.R., *See* Jacobsen, R.T., 14:35686
Blacker, T.D., *See* Stephenson, M.B., 14:37810
Blair, W.P., *See* Raymond, J.C., 14:37430
Blakely, J.M., Two dimensional phase equilibria at surfaces, 14:37671 (BA;FR)
Blanchard, M., *See* Desrochers, G., 14:35971
Blanchard, R.L., *See* Lloyd, V.D., 14:37278
See Semler, M.O., 14:37279
Bland, R.R., Feasibility of industrial coal conversion at Cornell University. Final report, 14:35542 (R;US)
Blank, A.B., X-ray fluorescence determination of bromides in cesium iodide with preliminary concentrating crystallization, 14:36712 (RA;SU;In Russian)
See Banik, V.V., 14:36807
Blann, M., Effects of realistic partial state densities on preequilibrium decay, 14:37616 (RA;XA)
Blasdell, R.C., *See* Herwig, K.W., 14:37639
Blatt, M., Alternative technologies for DSM in the commercial sector, 14:36325 (RA;US)
Blaylock, B.G., [Biospheric model validation in urban, terrestrial, and aquatic environments, Budapest, Hungary, Vienna, Austria, Neuherberg, and Schmallenberg, W. Germany, April 25–May 12, 1988]: Foreign trip report, 14:37661 (R;US)
See Hoffman, F.O., 14:37203
Blendell, J.E., *See* Handwerker, C.A., 14:36631
See Vaudin, M.D., 14:36535
Bloch, D., Direct photon and π^0 production by deep inelastic scattering of real photons inclusive and exclusive studies, 14:37547 (R;FR;In French)
Block, R.C., Technique for fission measurements of highly active and weak cross-section actinides, 14:37605 (R;US)
Blocker, C.A., *See* Kirsch, L.E., 14:37494
Blomberg, L.G., *See* Marklund, G.T., 14:37447
Bloom, G.R., *See* Muhlestein, L.D., 14:36187
Bloom, T.F., Health-hazard evaluation determination report No. 73-185-256, Electromotive-Division, GMC (Plant 2), Chicago, Illinois, 14:37186 (R;US)
Bloomer, M.A., *See* Abbott, T., 14:37596
Blum, B., *See* Menyhard, M., 14:36510
Blystone, S.L., *See* Knapp, F.F. Jr., 14:37320
Boatner, L.A., *See* Christen, D.K., 14:36952
Bobbert, D., *See* Buehler, H., 14:36581
Bock, R., *See* Awes, T.C., 14:37562

See Plasil, F., 14:37597
Boden, T.A., *See* Marland, G., 14:37173
Bodnarczuk, M., QA at Fermilab, 14:37029 (J;US)
Boegl, K.W., *See* Schreiber, G.A., 14:37376
Boeke, J.D., Regulation of yeast Ty element transposition, 14:37310 (RA;US)
Boeva, O.A., *See* Zhavoronkova, K.N., 14:36813
Bofill, J., *See* Womersley, W.J., 14:37122
Bogdanova, D.D., *See* Torgov, V.G., 14:36863
Bogdanova, N.E., *See* Askinazi, L.G., 14:37723
Bogdzel', A.A., Study on fragment charge and mass fragmentation in ^{235}U fission with resonance neutrons, 14:37604 (R;SU;In Russian)
Bogert, D., *See* Womersley, W.J., 14:37122
Bohme, C.G., *See* Haston, J.A., 14:35721
Bohn, C.L., Rf properties of high-T_c superconductors, 14:36954 (J;US)
Boilley, D., *See* Suraud, E., 14:37762
Bokhorst, J.J.M., *See* Hinde, D.J., 14:37607
See Newton, J.O., 14:37606
Bol'shakov, V.I., Thermal conduction of high-temperature steel foil shield for HTGR reactor, 14:36017 (RA;SU;In Russian)
Boldeman, J.W., *See* Hinde, D.J., 14:37607
Bolling, E., *See* Swindeman, R.W., 14:36474
Boltz, K., *See* Galiasso, R., 14:35704
Bonano, E.J., Demonstration of a performance assessment methodology for high-level radioactive waste disposal in basalt formations, 14:35792 (R;US)
Bonczyk, P.A., Suppression of soot in flames by alkaline-earth and other metal additives, 14:36866 (R;US)
Bond, G.M., *See* Robertson, I.M., 14:36533
Bond, P.D., *See* Abbott, T., 14:37596
Bondarev, B.I., On the matching of accelerating channel of ion linear accelerator at high currents, 14:37056 (RA;SU;In Russian)
Bondareva, N.V., *See* Zolotovitskaya, Eh.S., 14:36711
Bone, R.M., A guide to socio-economic impact monitoring in the Northwest Territories, 14:37283 (R;CA)
Bonert, R., Software development for a microprocessor based controller for ac-dc-ac diesel-electric freight locomotive power unit control, 14:36443 (R;CA)
Boneva, S.T., Intensive two-quantum cascades and fragmentation of quasiparticle states in some deformed nuclei, 14:37633 (R;SU;In Russian)
Bongartz, R., On the accident behaviour of the HTR-100. A risk-oriented analysis, 14:36157 (R;DE;In German)
Bonner, B.E., *See* Barnes, P.D., 14:37503, 14:37505
See Hertzog, D.W., 14:37504
Book, S., *See* Abrahamson, S., 14:37380
Booske, J.H., Free electron laser with small period wiggler and sheet electron beam: A study of the feasibility of operation at 300 GHz with 1 MW CW output power, 14:36961 (R;US)
Borak, T.B., Randomization of grab sample strategies for estimating the exposure of uranium miners to radon daughters, 14:35748 (RA;CA)
Borderie, B., *See* Rivet, M.F., 14:37472, 14:37578
Borel, H. and others, *See* Ait-Boubker, S., 14:37114
Borges, G.L., *See* Kortright, J.B., 14:36854
Borina, A.F., *See* Mazitov, R.K., 14:36802
Borisov, A.D., Software for the communication of the BESM-6 computer complex with peripheral centers, 14:37039 (RA;SU;In Russian)
Borisova, V.V., Dependence of animal life span shortening on dose rates in case of internal irradiation, 14:37369 (RA;SU;In Russian)
Borodina, L.A., Lithium, rubidium, and cesium cyclohexaphosphates, 14:36750 (RA;SU;In Russian)
Borovskij, I.V., On the acceleration of relativistic electron beam over dielectrical grid, 14:37061 (RA;SU;In Russian)
Bose, A., *See* Ruchti, R., 14:37109
Bosio, J.C., Rospo Mare, offshore Italy. An industrial development based on horizontal wells. Technical and economical aspects, 14:35610 (RA;CA)
Bossert, R.C., *See* Niemann, R.C., 14:36922
Bosteels, M., *See* Arnold, R., 14:37101
Bottcher, C., Probing nuclear currents with dilepton production in ultrarelativistic heavy-ion collisions, 14:37498 (R;US)
Boucher, J., *See* Slavik, J.N., 14:35741
Bouchet, D., Experimental evidence of sulfur effect on the plane and on the extrinsic dislocations of a $\Sigma = 3$ grain boundary in nickel, 14:36504 (BA;FR)
Bouchet, P., *See* Treves, A., 14:37431
Bouchez, J., *See* Ait-Boubker, S., 14:37114
Boudreaux, C.L., Radiation monitoring training system - an aid to performance-based training, 14:36141 (RA;US)
Boughton, B.A., *See* Spulak, R.G. Jr., 14:36195
Bouillard, J.X., *See* Lyczkowski, R.W., 14:35580
Bouldin, D.W., *See* Britton, C.L., 14:37798
See Britton, C.L. Jr., 14:37000
Bourcier, R.J., *See* Schmale, D.T., 14:36996
Bourdarios, G., Results of the Frejus experiment on nucleon decay, 14:37707 (R;FR)
Bourgeois, C., Collective structures in ^{185}Hg, 14:37591 (R;FR)
Shape coexistence at high spin in ^{187}Au, 14:37593 (R;FR)
Spin value of ^{184}Ir ground state, 14:37627 (R;FR)
See Kilcher, P., 14:37594
Bourke, P.J., *See* Berry, J.A., 14:37224
Bouten, W., Hydrologic system characterisation for biogeochemical process research in forest ecosystems, 14:37236 (RA;NO)
Bowden, G., Retractable carbon fibre targets for measuring beam profiles at the SLC collision point, 14:37126 (J;NL)
Bowers, R.L., Plasma flow switch characterization for the Los Alamos Foil Implosion Project, 14:37012 (R;US)
See Greene, A.E., 14:37003
See Parker, J.V., 14:37481
Boyarinov, V.F., Abstract of the RADIKF and RADIKF-ES programs, 14:36079 (RA;SU;In Russian)
Boyd, G.J., *See* Benjamin, A.S., 14:36177
Boyd, R.E., *See* Webb, J., 14:37348
Boyer, C.M., Measurement of static coalbed-reservoir conditions for hydraulic-fracture design. Volume 2. Final report, March 1983-December 1986, 14:35681 (R;US)
Boyer, J.H., *See* Pavlopoulos, T.G., 14:36958
Boyer, K., *See* Rhodes, C.K., 14:37463
Boyle, S.J., IUE spectrophotometry of the accretion disk of HZ Her/Her X-1, 14:37432 (RA;FR)
Boysen, J.E., Development of an advanced process for drying fine coal in an inclined fluidized bed: Technical progress report for the second quarter, January 19–March 31, 1989, 14:35513 (R;US)
Bozek, E. and others, *See* Vivien, J.P., 14:37586
Braby, L.A., *See* Toburen, L.H., 14:37663
Bradshaw, V.A., *See* McEntee, K., 14:37386
Bradshaw, W.M., Laboratory testing of a fluidized-bed dry-scrubbing process for the removal of acidic gases from a simulated incinerator flue gas: Final report, 14:36416 (R;US)
Brady, B., *See* Christianson, M.C., 14:35795
Brakke, D.F., Hydrologic and chemical characteristics of darkwater, clearwater and acidic lakes in the United States, 14:37267 (RA;NO)
Braski, D.N., *See* Haggag, F.M., 14:36984
Bratten, W.A., *See* Johnson, M.L., 14:37820
Bray, S.L., *See* Goodrich, L.F., 14:36940
Breakstone, A., *See* Adolphsen, C., 14:37096
Breger, D.S., An evaluation of solar heating systems with seasonal storage in New England. Systems using duct storage in rock and heat pump, 14:36198 (RA;CA;In English and French)
Breidenbach, G., *See* Reich, M., 14:36129
Brene, N., *See* Nielsen, H.B., 14:37528
Brennan, J.J., Interfacial characteristics of glass-ceramic matrix/SiC fiber composites, 14:36634 (BA;FR)
Bresolin, G., *See* Ziritt, J.L., 14:35607
Brett, C.E., *See* Schaetzle, W.J., 14:36218
Breunlich, W., *See* Barnes, P.D., 14:37503
See Hertzog, D.W., 14:37504
Breunlich, W.H., *See* Barnes, P.D., 14:37505
Brewer, L., History of the application of the generalized Lewis acid-base theory to metals, 14:36575 (R;US)
Briancon, Ch., *See* Mikhajlov, I.N., 14:37631
Briant, C.L., Intergranular fracture in metals, 14:36985 (BA;FR)

Briles, S.D., Significant improvement in IR surface-temperature measurements, 14:37137 (R;US)
Brindza, P., CEBAF superconducting spectrometer design, 14:36934 (J;US)
See Alcorn, J., 14:36943
See O'Meara, J., 14:36942
See Tuzel, W., 14:36937
Brinkmann, H.J., *See* Reimann, J., 14:36981
Brinster, K.F., *See* Bonano, E.J., 14:35792
Briscoe, F.H., *See* Boyer, C.M., 14:35681
Brisling, A., *See* Bergenlid, U., 14:36093
Bristowe, P.D., *See* Payne, M.C., 14:36487
Britt, H.C., *See* Fields, D.J., 14:37600
Brittain, C.R., *See* Otaduy, P.J., 14:36094
Britton, C.L., A virtual zero-time, monolithic systolic sorting array, 14:37798 (R;US)
Britton, C.L. Jr., Tool integration and enhancement for standard cell designs, 14:37000 (R;US)
Brklacich, M., Effects of climatic change on agricultural land resource potential, 14:37167 (RA;CA)
Broadhead, B.L., *See* Lillie, R.A., 14:36196
Broadus, C.R., *See* Domenico, W.F., 14:36047
Brockmann, J.E., *See* Yamano, N., 14:36163
Broders, M.A., [Discussions with International Energy Agency's Center for the Analysis and Dissemination of Demonstrated Energy Technologies concerned with database and analysis study series of reports, Sittard, Netherlands, May 22–26, 1989]: Foreign trip report, 14:37821 (R;US)
Brodskaya, A.V., *See* Apanasenko, V.V., 14:36822
Broemsen, U. von., *See* Sverdrup, H.U., 14:37272
Bronson, M.C., Electrorefining cell evaluation, 14:35758 (R;US)
Brouns, R.A., *See* Ross, W.A., 14:35804
Broussaud, D., *See* Thorel, A., 14:36671
Browall, K.W., *See* Roberts, R., 14:36222
Brown, B.A., *See* Marty, N., 14:37630
Brown, B.C., *See* Hanft, R.W., 14:36921
See Herrup, D.A., 14:36920
See Strait, J., 14:36912
Brown, D.J.A., Loch Fleet Project, 14:37244 (RA;NO)
Brown, D.W., Reservoir water loss modeling and measurements at Fenton Hill, New Mexico, 14:35942 (R;US)
Brown, J.K., In vitro radiosensitivity of human malignant melanoma cells to low and high LET radiation, 14:37350 (RA;AU)
Brown, K.L., *See* Haiessinski, J., 14:37066
See Toge, N., 14:37095
Brown, M.B., Frustration, the challenge and the victory of team building, 14:36045 (RA;US)
Brown, M.R., *See* McDonald, J.F., 14:37312
Brown, P.S., Ethics and nuclear weapons research, 14:36460 (R;US)
Brown, R.M., Field studies of HT oxidation and dispersion in the environment. I. The 1986 August experiment at Chalk River, 14:37225 (R;CA)
Brown, R.T., Measurement of upwelling flow from Upper Bear Creek reservoir air diffusers, 14:35899 (R;US)
Brownell, J.H., *See* Bowers, R.L., 14:37012
Browning, J.S., *See* Evans, E.P., 14:37002
Bruecher, K., Process and system for combustion, especially of slow-reacting coal dust, 14:35589 (R;DE;In German)
Bruemmer, S.M., Evaluating the intergranular SCC resistance of sensitized Type 304 stainless steel in low-temperature water environments, 14:36601 (BA;US)
Brunette, J.P., *See* Sastre, A., 14:36833
Brunstroem, C., The Lyckebo rock cavern seasonal storage plant experience of one year of operation, 14:35935 (RA;CA;In English and French)
Brust, F.W., *See* Christman, T.K., 14:36466
Bryan, W.L., *See* Britton, C.L. Jr., 14:37000
Brynestad, J., *See* Christen, D.K., 14:36952
See Sekula, S.T., 14:36949
Buchau, J., *See* Reinisch, B.W., 14:37452
Bucher, R.G., *See* Persiani, P.J., 14:35836
Bucheton, A., *See* Finnegan, D.J., 14:37311
Bucurescu, D., Investigation of the excited O^+ states in Cd-110 and Ce-1138, 14:37624 (RA;RO;In Romanian)
Budaev, M.A., Method for calculating hydrogen propagation accidents in NPP compartments under accidents, 14:36154 (RA;SU;In Russian)
Budal, J.D., *See* Christen, D.K., 14:36952
Budakov, A.A., *See* Bejder, B.D., 14:36563
Buehler, H., Studies on work-softening processes in the hot forming of austenitic steel, 14:36581 (TJ;US)
Buescher, B.J., *See* Ware, A.G., 14:35989
Bugaj, A.H., Analysis of a thermochemical energy storage system with liquid absorbents, 14:36217 (RA;CA;In English and French)
Buhl, R., *See* Fontana, M.H., 14:36180
Buie, S., The "Fabrikaglace" process to make and store natural ice, 14:36208 (RA;CA;In English and French)
Bukarov, V.A., *See* Anisimov, V.V., 14:36564
See Ishchenko, Yu.S., 14:36570
See Poloskov, S.I., 14:36562
Bukhalova, G.A., Four-component system of lithium, cesium, potassium, calcium bromides, 14:36788 (RA;SU;In Russian)
On the compounds of rubidium, cesium and lanthanum polyphosphates, 14:36748 (RA;SU;In Russian)
See Dzeranova, K.B., 14:36797
See Kaloev, N.I., 14:36796
See Mardirosova, I.V., 14:36747
Bukhta, O.Ya., *See* Belousov, A.N., 14:36566
Bukin, V.I., *See* Apanasenko, V.V., 14:36822
Bukka, K., *See* Yang, Y.J., 14:35718
Bulos, F., *See* Toge, N., 14:37095
Buncher, C., *See* Abrahamson, S., 14:37380
Bunger, J.W., Developments in upgrading of bitumen by hydropyrolysis, 14:35706 (RA;CA)
Bunyakina, N.V., *See* Shevchuk, V.G., 14:36779
See Storozhenko, D.A., 14:36782
Burbaev, T.M., *See* Aslanov, G.A., 14:37726
Burchill, W.E., *See* Sherrard, J.R., 14:36067
Burger, J., *See* Combe, J., 14:35611
Burger, M., *See* Giovannelli, F., 14:37434
Burke, D., *See* Bowden, G., 14:37126
Burke, D.L., *See* Haiessinski, J., 14:37066
See Toge, N., 14:37095
Burke, J.A., Computer aided process planning conceptual design and functional specification, 14:36879 (R;US)
Burke, N.E., Improved techniques for measuring heavy crude oil vapor pressures for monitoring tank emissions, 14:35663 (RA;CA)
Burkhardt, J.E., *See* Fraval, F.D., 14:36407
Burkholder, H.C., *See* Ross, W.A., 14:35804
Burkholder, J.M., Microbial colonization on natural and artificial macrophytes in a phosphorus-limited, hardwater lake, 14:37252 (J;US)
Burlakov, I.A., *See* Poloskov, S.I., 14:36562
Burov, A.A., *See* Andreev, V.A., 14:37083
Burtsev, I.A., *See* Sedov, V.M., 14:36717
Busch, M., *See* Niessen, H.F., 14:36024
Bush, L.L., Fitness for duty in the nuclear power industry: Responses to public comments, 14:36052 (R;US)
Busing, W.R., Full-pattern refinement of crystalline polymer fibers based on diffractometer measurements, 14:36664 (R;US)
Busseau, I., *See* Finnegan, D.J., 14:37311
Butkus, S.R., Pilot program for water quality data collection by volunteers, 14:35898 (R;US)
Butler, B., *See* Beninga, K., 14:35926
Butler, R., Generating alignments of genetic sequences, 14:37285 (R;US)
Butler, R.M., *See* Chung, K.H., 14:35709
Butler, T., *See* Butler, R., 14:37285
Butler, W.H., *See* Swihart, J.C., 14:37695
Butterfield, C.P., Three-dimensional airfoil performance measurements on a rotating wing, 14:35952 (R;US)
Butterfield, D.W., *See* Allen, B.L., 14:36229
Butylkin, B.B., Effect of construction of current and gas supply on protective atmosphere composition in welded installation, 14:36565 (RA;SU;In Russian)
Bychkov, V.M., Analysis of threshold reaction cross-sections and spectra of particles emitted in them on iron-group nuclei, 14:37618 (RA;XA)

Byers, C.H., *See* Watson, J.S., 14:36706
Byrski, T., *See* Vivien, J.P., 14:37586
Bystrov, V.M., Amplification klystron for resonance electron accelerators, 14:37080 (RA;SU;In Russian)
Bystrova, N.M., *See* Melkumyants, M.V., 14:36773
Bytnerowicz, A., *See* Martin, B., 14:37396

C

Cabane, F., New ideas on interface structure from significant disagreements between experiments and prediction of interface composition in Ag base alloys, 14:36505 (BA;FR)
Cabane, J., *See* Cabane, F., 14:36505
Cabanel, C., *See* Laval, J.Y., 14:36672
Cacciola, G., *See* Restuccia, G., 14:36211
Cadena, F., *See* Peters, R.W., 14:37216
Cahn, R.N., Present and future searches for the Higgs Boson with the MEVVA high current metal ion source, 14:37527 (R;US)
Cail, K., *See* Bedard, C., 14:36661
CAIL, K., *See* Bedard, C., 14:36660
Cain, P., Fly ash/cement packing for Lingan Mine: final appraisal and trial proposal, 14:35561 (R;CA)
Cain, W.G., Heat exchanger development for steam-injected Brayton cycle: Final report for period September 30, 1984 to April 30, 1988, 14:36577 (R;US)
Caird, R.S., *See* Fowler, C.M., 14:37004
See Goforth, J.H., 14:37734
See Reinovsky, R.E., 14:37013
Calcote, H.F., *See* Berman, C.H., 14:35687
Callahan, A.P., *See* Knapp, F.F. Jr., 14:37320
Callahan, R., Two families of human endogenous retroviral genomes, 14:37290 (RA;US)
Callan, C.G., Using reparametrization invariance to define vacuum infinities in string path integrals, 14:37559 (J;NL)
Callas, J.L., *See* Abe, K., 14:37499
Camerini, U., *See* Barger, V., 14:37491
Camfield, R., Market segmentation and pricing for competitive markets, 14:36311 (RA;US)
Camm, D., *See* Whitehead, L., 14:36399
Camp, B.S., *See* Boyer, C.M., 14:35681
Campbell, D.J., *See* Reilly, H.J., 14:36182
Campbell, E.M., High intensity laser-matter interactions, 14:37745 (B;US)
Campbell, M.J., A preliminary pH analysis of coal slurries from the Sydney Coalfield, N.S., 14:35570 (R;CA)
Campiani, A., Institutional aspects of DSM in Italy, 14:36328 (RA;US)
Cantor, R., The economics of nuclear power: further evidence on learning, economies of scale, and regulatory effects, 14:36064 (J;NL)
Cap, J.S., *See* Dreike, P.L., 14:37775
Capes, H., *See* Ghendrih, P., 14:37719
Carden, R.S., Calculating the maximum horizontal wellbore length, 14:35700 (RA;CA)
Carey, G.F., Computational fluid dynamics (CFD): element-by-element analysis for advanced computers. Final report, 1 April 1987-14 November 1988, 14:37479 (R;US)
Carillo Heredero, J.D., *See* Komissarova, L.N., 14:36745
Carl, D.R. Jr., *See* Coe, R.P., 14:35985
Carlini, R., *See* Brindza, P., 14:36934
Carlsmith, D., *See* Barger, V., 14:37491
Carlson, R.W.S., Some aspects of HIFAR design, 14:36119 (RA;AU)
Carlton, H.E., *See* Tewksbury, T.L., 14:35532
Carnal, C.L., Simulation of a continuous rotary dissolver, 14:35763 (R;US)
Carney, M., *See* Krochmalnek, L.S., 14:35770
Carpenter, J.M., Neutron transmission of single crystal MgO filters, 14:37097 (J;NL)
Carr, F.H., HIFAR - project organization design and procurement, 14:36117 (RA;AU)
Carroll, D.G., *See* White, J.D., 14:36027
Carruthers, P., Multiplicity fluctuations in finite rapidity windows. Intermittency or quantum statistical correlation?, 14:37540 (J;NL)
Carson, D., *See* Ignasiak, B., 14:35547
Carson, J.A., *See* Niemann, R.C., 14:36922
Carta, G., *See* Scott, C.D., 14:35905
Carter, C.B., Hetero- and homo-phase boundaries in ceramic oxides, 14:36626 (BA;FR)
See Cho, N.H., 14:36670
Carter, D.H., SiC-$MoSi_2$ composites, 14:36638 (R;US)
Carter, J.W., *See* Geraci, C.L., 14:37180
Carter, R.J., Feasibility of quantitative performance measures for evaluating nuclear power plant operators, 14:36046 (RA;US)
Cartwright, D.C., *See* Harris, D.B., 14:37770
Caspi, S., *See* Pope, W.L., 14:36923
Cassatella, A., *See* Sanz Fernandez de Cordoba, L., 14:37429
Castets, C., 1987 ILL experimental reports and theory college activities, 14:37417 (R;FR)
Castro, C.E., *See* Perucca, J.C., 14:37403
Castro, R, *See* Kamenetzky, E.A., 14:36596
Castro, R.G., *See* Maley, M.P., 14:36945
Cata, G., *See* Bucurescu, D., 14:37624
Cataldo, D.A., Absorption, distribution, and fate of neptunium in plants, 14:37233 (J;US)
Cathcart, J.V., *See* Horton, J.A., 14:36608
Cathey, N.G., *See* Sattison, M.B., 14:36174
Caves, D.W., Estimating outage costs from demand analysis, 14:36294 (RA;US)
Importance of market segmentation in new service and rate offerings, 14:36314 (RA;US)
Cazoll, V., Theoretical and numerical study of cyclotron in space charge conditions, 14:37052 (R;FR;In French)
Cebrelli, E., *See* Perucca, J.C., 14:37403
Celler, A., *See* Watson, J. W., 14:37579
Ceman, D.L., *See* O'Hern, T.J., 14:37145
Cena, R.J., Lawrence Livermore National Laboratory oil shale quarterly report, January–March 1989, 14:35731 (R;US)
Center, J., Developing software to use parallel processing effectively. Final report, June-December 1987, 14:37797 (R;US)
Centre de Spectrometrie, *See* Anne, R., 14:37682
CERN-Dortmund-Edinburgh-, *See* Schaffer, A.C., 14:37544
Cesari, C., *See* Faure, J.P., 14:36494
Cha, C.Y., *See* Boysen, J.E., 14:35513
Chace, A.S., Combustion research opportunities for industrial applications: Phase II, 14:36412 (R;US)
Chacin, E., Feasibility of steam injection at 8200 feet, 14:35617 (RA;CA)
Chaim, R., *See* Pirouz, P., 14:36691
Chakma, A., Jet cracking. A novel coke free visbreaking process, 14:35736 (RA;CA)
Chakrabartty, S.K., *See* Parkosh, S., 14:36734
Chakrobartty, S.K., *See* Parkash, S., 14:36733
Chamberlin, E.P., *See* Fairbank, W.M. Jr., 14:37139
Chamberlin, J., *See* LeBlanc, W., 14:36275
Chamberlin, J.H., Strategic integration of pricing and demand-side management, 14:36284 (RA;US)
Chambers, D.H., Linear theory of uncompensated thermal blooming in turbulence, 14:37486 (R;US)
Chambers, N.A., *See* Elgert, B.D., 14:35630
Chambon, B., *See* Drain, D., 14:37116
Champagne, B., Solid-state interaction between nickel and $YBa_2Cu_3O_x$, 14:36646 (R;CA)
See Parent, L, 14:36645
Chan, C., *See* Morgan, M.A., 14:37785
Chan, Y., *See* Pouliot, J., 14:37599
Chandler, V.L., DNA modification of Mu elements in maize, 14:37313 (RA;US)
Chang, C.S., Tokamak electrical conductivity modified by electrostatic trapping in the applied electric field, 14:37741 (R;US)
Chang, Ging-Song, *See* Kutter, B.L., 14:37159
Chang, Shen-Lin, *See* Lyczkowski, R.W., 14:35580
Chang, T., *See* Crew, G.B., 14:37450
Chao, B.T., *See* Sha, W.T., 14:36979
Chao, H., Price differentiation by time and by service, 14:36283 (RA;US)
Chapman, J.E., *See* Panter, H.C., 14:37354
Chappuis, P., *See* Grosman, A., 14:37760

Charal, A., Interfacial structure modifications induced by sulfur in Ag-Ni alloys, 14:36506 (BA;FR)
Charewicz, W.A., *See* Walkowiak, W., 14:36834
Chargin, A.K., CEBAF, a large scale application of superconducting rf, 14:36896 (J;US)
Charity, R.J., *See* Newton, J.O., 14:37606
Charlier, M., Model of a heating installation consisting of solar collectors, storage tank and heat pump, 14:35937 (RA;CA;In English and French)
Charpin, J., *See* Roth, E., 14:37754
Charvet, A., *See* Genevey, J., 14:37581
Charvet, J.L., *See* Jahnke, U., 14:37603
Chase, S., The Husky bi-provincial upgrader design basis, 14:35727 (RA;CA)
Chasman, C., *See* Abbott, T., 14:37596
Chastain, S.A., *See* Gilpin, L.L., 14:36037
Chatterjee, A., *See* Newton, J.O., 14:37606
Chea, C.K., *See* Burke, N.E., 14:35663
Chekmarev, A.M., State of water in extracts and its interaction with microwave field, 14:36824 (RA;SU)
Chel, S., Heavy ions beam axial injection tudy in a compact cyclotron, 14:37075 (R;FR;In French)
Chen, F.K., *See* Luongo, C.A., 14:36916
Chen, F.R., *See* King, A.H., 14:36490
Chen, F.S., *See* King, A.H., 14:36527
Chen, L.K., *See* Swenson, C.A., 14:37034
Chen, L.Q., *See* Counterman, C., 14:36669
Chen, L.Y., Optical properties of metals and alloys: Au, Ag, FeRh, $AuAl_2$, and $PtAl_2$, 14:36604 (D;US)
Chen, Liu, On field line resonances of hydromagnetic Alfven waves in dipole magnetic field, 14:37458 (R;US)
Chen, P., *See* Rajagopalan, S., 14:37065
Chen, S.P., Simulation study of interfaces in Ni, Al and Ni_3Al with and without boron, 14:36488 (BA;FR)
Chen, Z., *See* Abbott, T., 14:37596
Cheng, C.C., Cross-sectional TEM [transmission electron microscopy] studies of Cr films deposited by ion-assisted deposition and physical vapor deposition, 14:36472 (R;US)
See Erdemir, A., 14:36478
Cheng, J.T., Josephson effect research in high-temperature superconductors. Interim report, 30 September 1987-29 September 1988, 14:36609 (R;US)
Chengye Yuan, Trials on the molecule design of organic extractants, 14:36841 (RA;SU)
Cherginets, V.L., *See* Banik, V.V., 14:36804
Chermant, J.L., *See* Bary, A., 14:36673
See Vicens, J., 14:36628
Chernorukov, N.G., *See* Egorov, N.P., 14:36795
Chernousov, Yu.D., *See* Ivannikov, V.I., 14:37082
Chernov, A.I., *See* Mozgovoj, A.G., 14:36554
Cherry, M.L., Measurement of solar proton-proton fusion neutrinos with a Soviet-American gallium experiment: Technical progress report, 14:37583 (R;US)
Chesnokov, V.M., *See* Antipov, S.P., 14:37768
Chesson, J., *See* Karaffa, M.A., 14:37181
Chetchueva, M.Eh., Radiobiological effects of fractionated intake of ^{3}H-nucleosides by mammalian organism, 14:37368 (RA;SU;In Russian)
Cheverton, R.D., Impact of an apparent radiation embrittlement rate on the life expectancy of PWR [pressurized-water-reactor] vessel supports, 14:36006 (R;US)
Chew, M.S., *See* O'Meara, J., 14:36942
Cheynis, B., *See* Drain, D., 14:37116
Chiappetti, L., *See* Treves, A., 14:37431
Chiba, S., Some remarks on the neutron elastic- and enelastic-scattering cross sections of palladium, 14:37585 (R;US)
Chibrikina, E.I., *See* Chekmarev, A.M., 14:36824
Chikwambani, S., *See* Menyhard, M., 14:36510
Childs, R.L., *See* Rhoades, W.A., 14:37381
Chiles, M.M., Multi-energy neutron detector for counting thermal neutrons, high-energy neutrons, and gamma photons separately, 14:37133 (R;US)
Chin, D.K., Characterization of YBaCuO and ErBaCuO thin films deposited on silicon and gallium arsenide substrates, 14:36899 (J;US)
Chiosila, I., Evaluation of human internal irradiation owed to Cs-134 and Cs-137 from food after 26.04.1986, 14:37346 (RA;RO;In Romanian)
Chipman, D., *See* Aston, T.R.C., 14:35567
Chirico, R.D., *See* Steele, W.V., 14:35664
Chirovici, M., *See* Chiosila, I., 14:37346
Chiu, S., Methodology for hazardous waste surveys, 14:35779 (R;US)
Cho Kim, B., *See* Tewksbury, T.L., 14:35532
Cho, N.H., Grain boundaries and antiphase boundaries in GaAs, 14:36670 (BA;FR)
Choi, U.S., Long-term degradation of dilute polyacrylamide solutions in turbulent pipe flow, 14:36422 (R;US)
See Liu, K.V., 14:36976
Chornet, E., *See* Chakma, A., 14:35736
Chou, C.J., *See* Connelly, M.P., 14:35814
Chou, C.K., *See* Witte, M.C., 14:36014
Chou, M.Y., Compton profile of graphite and lithium-intercalated graphite, 14:36684 (BA;US)
Chou, T., *See* Bingham, P.M., 14:37291
Christen, D.K., Anisotropies in the magnetic penetration depth and critical current density of $R_1Ba_2Cu_3O_{7-x}$ (R = Y or Ho), measured on magnetically-aligned powder composites, 14:36952 (J;US)
See Sekula, S.T., 14:36949
Christensen, J., *See* Moore, C.,.14:36162
Christensen, L.R., Revenue and rates of return requirements, 14:36295 (RA;US)
Christensen, T.M., *See* Sorensen, N.R., 14:36595
Christiansen, P.D., *See* Simons, C.A., 14:35865
Christianson, M.C., Analysis of alternative waste isolation concepts, 14:35795 (R;US)
Christman, T.K., Crack growth behavior and modeling: Topical report, 14:36466 (R;US)
Christoffersen, D.A., *See* Clark, C.M., 14:35845
Christophel, E., *See* Arnold, R., 14:37101
Chruscielewski, W., Radon concentrations in air of Polish underground coal mines, 14:35597 (RA;CA)
Chu Tsonglun, Improved reliability of residual heat removal capability in pressurized water reactors, 14:36176 (BA;DE)
Interfacing systems LOCAs at boiling water reactors, 14:36178 (BA;DE)
Chu, Y.Y., *See* Abbott, T., 14:37596
Chuard, D., *See* Hadorn, J.C., 14:35933
Chuard, P., *See* Hadorn, J.C., 14:35933
Chudinova, N.N., *See* Borodina, L.A., 14:36750
Chumakova, G.M., *See* Skorovarov, D.I., 14:36719
Chun, R.C., *See* Mok, G.C., 14:36894
Chun-Hui Huang, Studies of the influence of different anions on extraction of neodymium with di(1-methylheptyl)methyl phosphonate, 14:36826 (RA;SU)
Chung, K.H., A theoretical and experimental study of steam-assisted gravity drainage process, 14:35709 (RA;CA)
Chung, Suh-Urk, Glueballs, hybrids, and exotic hadrons, 14:37490 (B;US)
Cicchetti, C.J., Cogeneration and competition, 14:36323 (RA;US)
Cielo, P., Laboratory investigation on the evaluation of crude oil concentration by spectroscopic methods, 14:35665 (R;CA)
Cimolino, M., *See* Muller, C.H. III, 14:36973
Cimpl, Z., *See* Kosek, F., 14:37678
Claesson, G., *See* Awes, T.C., 14:37562
See Plasil, F., 14:37597
Clark, C.M., Modular economical PC-based alarm display system, 14:35845 (R;US)
Clark, D.A., *See* Rich, P.M., 14:35918
Clark, D.B., *See* Rich, P.M., 14:35918
Clark, T.L., *See* Langley, R.A., 14:37758
Clarke, J., *See* Fan, N.Q., 14:36905
See Ferrari, M.J., 14:36897
See Rosenthal, P., 14:36900
See Wellstood, F.C., 14:36903
Clarke, R.T., *See* Goss-Custard, J.D., 14:35945
Clarke, W.P., *See* Jacobsen, R.T., 14:35686

Clayton, C.R., *See* Helfand, M.A., 14:36366
Cleary, H.J., Nuclear waste package container corrosion in simulated salt repository environments, 14:35819 (BA;US)
Clements, W.E., *See* Gudiksen, P.H., 14:37164
Clerc, C., Impedance spectroscopy for the study of anodic copper dissolution in sulfuric acid in presence of benzotriazole, 14:36367 (BA;US)
Clesceri, L.S., Recycling of cellulose enzyme complex after cellulose hydrolysis. Final report, 14:35863 (R;US)
Clever, J.J., Computer site threat identification and analysis, 14:37809 (R;US)
Clewing, G., *See* Awes, T.C., 14:37562
See Plasil, F., 14:37597
Clifft, B., *See* Shepard, K.W., 14:37069
Clifton, D.R., Evolution of technician and maintenance training, 14:36004 (RA;US)
Clinard, J.A., Approaching distributed database applications using a programmable terminal emulator, 14:37819 (R;US)
Clinton, J.H., *See* Soo, P., 14:35794
Clough, S., *See* Samuelson, L., 14:36659
Clouthier, D.J., Laser spectroscopy and dynamics of combustion intermediates: Three year progress report, 1 June 1986–31 May 1989, 14:36868 (R;US)
Coats, R.S., *See* Stinnett, R.W., 14:37780
Cochrane, J.C., Foil implosion studies on PEGASUS, 14:37686 (R;US)
Cockshutt, D., New developments in beam pumping technology PC 3000, 14:35723 (RA;CA)
Coe, R.P., Team skills training: the critical next step at GPU Nuclear, 14:35985 (RA;US)
Coffey, H., *See* Rote, D.M., 14:36401
Coffey, K.R., Reaction kinetics of phase formation in Nb-Al powder metallurgy processed wire, 14:36944 (J;US)
Coffin, P., Horizontal well application in the Pelican Lake and winter reservoirs, 14:35631 (RA;CA)
Cohen, M.L., *See* Chou, M.Y., 14:36684
Cohen, S.J., Experiences in modelling water and land resources within a climate change framework, 14:37166 (RA;CA)
Colantonio, A., Thermographic inspections of building enclosures, 14:36395 (R;CA;In English and French)
Colantonio, T., Thermal resistance measurement, 14:36396 (R;CA;In English and French)
Cole, B.A., *See* Abbott, T., 14:37596
Cole, J.A., *See* Muzio, L.J., 14:37197
Cole, K., *See* Cielo, P., 14:35665
Cole, K.C., *See* Crine, J.-P., 14:36728
Cole, R.J., *See* Diamond, L., 14:36255
Colenbrander, G.W., *See* Witlox, H.W.M., 14:37178
Colgan, E.G., *See* Carter, C.B., 14:36626
College, J., *See* Babu, M., 14:35958
Collings, E.W., Compacted 1-2-3 ceramic powders treated as superconducting composites, 14:36653 (J;US)
See Gregory, E., 14:36938
Collins, C.B., Gamma-ray-laser pump diagnostic. Final report, 14:37582 (R;US)
Collins, J.L., *See* Norwood, K.S., 14:36184
Colonomos, P., *See* Chacin, E., 14:35617
Comaskey, B., Sideband generation in saturated pulsed dye amplifiers with multiple cw single mode injection, 14:36969 (BA;US)
Combe, J., New technologies in termalrecovery contribution of horizontal wells, 14:35611 (RA;CA)
Comber, C., *See* Dyer, C.S., 14:37129
Comfort, W.J. III, *See* Stein, W., 14:36982
Conell, S., TDPAD measurements of implantation temperature dependance in ^{19}F implanted diamond, 14:37677 (RA;ZA)
Connell, P.S., Evaluating CFC [chlorofluorocarbon] alternatives from the atmospheric viewpoint: Revision 1, 14:37196 (R;US)
Connell, S.H., *See* Von Wimmersperg, U., 14:37622
Connelly, E.M., *See* Carter, R.J., 14:36046
Connelly, M.P., Assessment of Basalt Waste Isolation Project's borehole mud pits soils and sediments for chemical constituents: Summary report, 14:35814 (R;US)
Conservatoire National d, *See* Roth, E., 14:37754
Contini, S., SALP-PC - A fault tree code on personal computer for plant safety assessment, 14:35980 (RA;XA)
Conway, J.T., *See* Cwalina, G.C., 14:36051
Cook, B.A., *See* Akers, D.W., 14:36191
Cook, E., *See* Iverson, L.R., 14:35923
Cook, E.A., *See* Graham, R.L., 14:37338
Cook, J.C. Jr., Contamination of reflective foils in horizontal applications and its effect on thermal performance, 14:36375 (R;US)
Cook, R.L., *See* Sammells, A.F., 14:35861
See Shepard, W.S., 14:36345
Cook, T.M., *See* Simpson, R.L., 14:36847
Cooke, D.L., *See* Morgan, M.A., 14:37785
Cooke, K.J., HIFAR : aspects of construction - United Kingdom and Australia, 14:36118 (RA;AU)
Cooley, R.A., New performance-based examination program for licensed reactor operators, 14:36042 (RA;US)
Cooper, B.H., Resonant charge-exchange studies with hyperthermal-energy ion beams: development of multi-detection capabilities and a data acquisition system. Final report, 15 November 1986-14 May 1988, 14:37460 (R;US)
Cooper, J.A., Communication techniques for safely transmitting and verifying unique signals, 14:37157 (R;US)
Cooper, K., *See* Diamond, L., 14:36255
Copeland, E., Ground state of high-density matter, 14:37541 (J;NL)
Copeland, N.G., *See* Strobel, M.C., 14:37306
Copenhaver, E.D., *See* Abercrombie, J.S., 14:35824
Copenhaver, R.M., *See* Eser, Semih, 14:35643
Coplin, K.A., *See* McGrath, M.A., 14:37427
Copp, R.D., *See* Fontana, M.H., 14:36180
Corbett, G.R., *See* Campbell, M.J., 14:35570
Corbett, R. E., *See* Balmer, J., 14:37752
Corces, V.G., *See* Geyer, P.K., 14:37308
Cordier, J.J., *See* Grosman, A., 14:37760
Coressel, T.W., *See* Fleissner, J.G., 14:35843
Correa, A., *See* Bediaga, I., 14:37516
Corti, A., Athabasca mineable oil sands. The RTR/Gulf extraction process theoretical model of bitumen detachment, 14:35717 (RA;CA)
Corum, J.M., Evaluation of weldment creep and fatigue strength-reduction factors for elevated-temperature design, 14:36083 (R;US)
Cosandey, F., Grain boundary internal friction and relationship to intergranular fracture, 14:36521 (BA;FR)
Coskuner, G., Prevention of formation damage through injection and production practices in heavy oil reservoirs, 14:35726 (RA;CA)
Cosme, G., *See* Augustin, J.E., 14:37571
Costa, C., *See* Reffo, G., 14:37611
Costello, J.F., *See* Hsieh, B.J., 14:36085
Costerton, B., *See* Singh, S., 14:35707
Costin, L.S., *See* Bauer, S.J., 14:35809
Cote, G.O., *See* Davis, G.D., 14:36461
Cotorobai, F., *See* Arakelian, S.G., 14:37520, 14:37521
Cottingham, J.G., *See* Wanderer, P., 14:36908
Coubrough, L.E., Compact ceramic heat exchangers. Final report, February 1983-June 1988, 14:35688 (R;US)
Couchot, F., Three and five photon decays of the J/PSI (3097), 14:37553 (R;FR)
Couchot, F. and others, *See* Augustin, J.E., 14:37571
Coufal, H., *See* Rosencwaig, A., 14:36616
Coulter, K., *See* Young, L., 14:37572
Coulter, R.L., *See* Gudiksen, P.H., 14:37164
Counterman, C., Molecular dynamics study of the structure and properties of twist boundaries, 14:36669 (BA;FR)
Court, A.L., The newGrade upgrader, 14:35728 (RA;CA)
Cousinou, M.C., *See* Ait-Boubker, S., 14:37114
Cousins, T.D., *See* Matter, J.C., 14:35850
Couture, R., Rural and native housing demonstration program. Report and construction manual, 14:36398 (R;CA)
Covington, B.C., *See* Newberger, B., 14:37049
Cowan, J.H. Jr., Distribution, abundance, and transport of larval sciaenids collected during winter and early spring from the continental shelf waters off west Louisiana, 14:37254 (J;US)
Cowden, W.G., The use of glass slides for preparing cross-section TEM samples of discrete transistors, 14:36687 (BA;US)

Cowell, T.H., *See* Widen, W.C., 14:36136
Cowley, S.C., *See* Chen, Liu, 14:37458
Cox, R., *See* VanArsdale, R., 14:37411
Crabol, B., Test emission of uranium hexafluoride in atmosphere. Results interpretation, 14:37198 (R;FR;In French)
Craig, D., *See* Nicolson, J.A., 14:37262
Craig, D.F., Structural ceramics in the advanced materials world, 14:36473 (R;US)
Cramer, B., *See* Jahnke, U., 14:37603
Cramer, P.G., *See* Chambers, D.H., 14:37486
Cramer, T.L., GRI (Gas Research Institute) catalog of technical reports, 14:35668 (R;US)
Crane, A.T., *See* Fulkerson, W., 14:36245
Crane, C.M., Customer response to real-time pricing, 14:36301 (RA;US)
Crawford, L.W., Two dimensional modeling of fluid mechanics, heat transfer, and NO decomposition in the CFFF radiant furnace, 14:36358 (BA;US)
Crawley, G.M., *See* Marty, N., 14:37630
Crew, G.B., Path-integral formulation of ion heating, 14:37450 (R;US)
Crine, J.-P., Determination of the nature and content of antioxidant and antioxidant synergist in PE and XLPE used in cables, 14:36728 (R;CA)
Crist, B., *See* Wignall, G.D., 14:36680
Crooks, L., *See* Groenemeyer, D.H., 14:37317
Cross, J.B., Atomic oxygen-MoS_2 chemical interactions, 14:36844 (R;US)
Croucher, D.W., Plant life extension program for the Advanced Test Reactor, 14:36114 (R;US)
Crowe, K.M., Medium energy meson physics: [Progress report, 1981–1983], 14:37564 (R;US)
Medium energy meson physics: Progress report, January 1, 1986 through December 31, 1986, 14:37565 (R;US)
Medium energy meson research, 14:37506 (R;US)
[Medium energy meson research]: [Progress report], 14:37570 (R;US)
Csencsits, R., Preparation of zeolites for TEM using microtomy, 14:36688 (BA;US)
Csink, A.K., *See* McDonald, J.F., 14:37312
Cubbage, J.C., *See* Ford, J.K.B., 14:35661
Cudmak, S.S., *See* Carpenter, J.M., 14:37097
Cugini, A.V., Coal/oil coprocessing mechanism studies, 14:35546 (J;US)
Culea, M, Electron impact fragmentation study of compounds from colour photosensible materials, 14:37469 (RA;RO;In Romanian)
Culioli, J.C., Chaotic behavior in a new class of parallel optimization algorithms, 14:37799 (R;US)
Cull, T.A., Safety testing program for the Galileo mission radioisotope thermoelectric generator, 14:36158 (R;US)
Cullen, R.T., *See* Love, R.G., 14:37191
Cumalat, J.P., [Studies of elementary particles and high energy phenomena: [Progress report], 14:37495 (R;US)
Cummings, G.E., Overview of the development of seismic safety assessment techniques for nuclear power plants, 14:36169 (BA;DE)
See Prassinos, P.G., 14:36170
Cummings, J.C., *See* Spulak, R.G. Jr., 14:36195
Cunningham, M.A., *See* Benjamin, A.S., 14:36177
Curien, D., *See* Vivien, J.P., 14:37586
Curtis, C.W., Improved performance in co-processing through fundamental and mechanistic studies in hydrogen transfer and catalysis: Quarterly report, December 27, 1988–March 27, 1989, 14:35526 (R;US)
See Guin, J.A., 14:35556
Cusack, F., *See* Singh, S., 14:35707
Cussol, D., *See* Suraud, E., 14:37762
Cutoiu, D., *See* Bucurescu, D., 14:37624
Cutts, D., A microprocessor farm architecture for high speed data acquisition and analysis, 14:37103 (R;US)
Data acquisition at D0, 14:37105 (R;US)
Neural networks for event filtering at Dv, 14:37106 (R;US)
Offline computing farms, 14:37028 (R;US)
See Abe, K., 14:37499
See Barter, C., 14:37104
See Lanou, R.E. Jr., 14:37500
Cwalina, G.C., Compilation of fastener testing data received in response to NRC Compliance Bulletin 87-02, 14:36051 (R;US)
Cyr, N., *See* Ignasiak, B., 14:35547

D

Dabrowski, B., *See* Hinks, D.G., 14:36615
Dacal, A., *See* Pouliot, J., 14:37599
Dadyburjor, D.B., Deactivation of hydrotreatment catalysts used for coal liquids: Semi-annual report, 12 May 1988–11 November 1988, 14:35525 (R;US)
Dahl, P., *See* Wanderer, P., 14:36908
Dahmen, U., *See* Pirouz, P., 14:36691
Dai, Hai-Lung, [Dynamics of vibrationally excited polyatomic molecules and their unstable isomers on the electronic ground state potential surface]: Progress report, 14:36740 (R;US)
Dalenbaeck, J.-O., A solar heating plant with heat pump and seasonal storage. System design influence on thermal performance and economy, 14:35936 (RA;CA;In English and French)
Daley, J.R., *See* Voycik, J.J., 14:36418
Dallaire, S., *See* Inoue, Z., 14:36644
See Ladouceur, M, 14:36643
See Parent, L, 14:36645
Daly, D.J., *See* Hassett, D.J., 14:37217
Daly, T., *See* Comaskey, B., 14:36969
Daniels, E., *See* Rote, D.M., 14:36401
Danielsen, A., *See* Sveum, P., 14:35662
Danilov, N.A., Regularities of the extraction of rare earth elements with triisoamyl phosphate, 14:36842 (RA;SU)
See Korpusov, G.V., 14:36820, 14:36843
Danziger, J., *See* Raymond, J.C., 14:37430
Darnell, R.A., Target cueing and tracking system for safeguards and security, 14:35851 (R;US)
Darrah, S., Jet-fuel deoxygenation. Interim report, March 1987-July 1988, 14:35642 (R;US)
Das, B., Methane desorption in coal handling, 14:35548 (R;CA)
Dasgupta, P.K., Novel approaches to ionic chromatography: Progress report, December 1, 1987–June 30, 1989, 14:36707 (R;US)
Datar, V., *See* Langevin-Joliot, H., 14:37588
Datye, A.K., *See* Cowden, W.G., 14:36687
Dautet, H., *See* Bourgeois, C., 14:37627
See Kilcher, P., 14:37594
Davanzo, A.C., *See* Lederer, C.C., 14:36254, 14:36427
Davenport, A.J., *See* Isaacs, H.S., 14:36368
David, P.H., *See* Bongartz, R., 14:36157
Davies, L.S.T., *See* Addison, J., 14:37190
Davies, P.B., *See* Lappin, A.R., 14:35811
Davis, C.M., *See* McIsaac, C.V., 14:36194
Davis, G.D., Evolution of the chemistry of passive films of sputter-deposited, supersaturated Al alloys. Annual report, 1 July 1987-30 November 1988, 14:36461 (R;US)
Davis, L.E., Chiral organic crystals for high power frequency conversion, 14:37781 (R;US)
Davis, P.A., *See* Bonano, E.J., 14:35792
Davison, B.H., Characterization and subsequent utilization of microbially solubilized coal: Preliminary studies, 14:35519 (R;US)
Daw, M.S., *See* Baskes, M.I., 14:36514
Dawson, A.M., *See* Marston, P.G., 14:36918
Dawson, W.H., *See* Chakma, A., 14:35736
De Angelis, R.J., *See* Reucroft, P.J., 14:36482
de B. Regina, M.M.A., *See* Ribelo de Azambuja, A., 14:35614
de Rocco, M., *See* Singh, S., 14:35707
de Voghel, L., Discussion on planning and DSM, 14:36331 (RA;US)
Tariffs used for load management in Europe, 14:36333 (RA;US)
Dean, R.S., Closeout of IE Bulletin 83-06: Nonconforming materials supplied by Tube-Line Corporation Facilities at Long Island City, New York; Houston, Texas; and Carol Stream, Illinois, 14:35841 (R;US)
See Foley, W.J., 14:36164
Dean, S.O., Impact of high temperature superconductors on the possibility of radio-frequency confinement, 14:36914 (J;US)
Dechamps, M., *See* Barbier, F., 14:36633

Declais, Y., *See* Ait-Boubker, S., 14:37114
DeFaccio, M.A., *See* Muller, C.H. III, 14:36973
Degen, G., *See* Bongartz, R., 14:36157
Deis, G.A., *See* Shay, H.D., 14:36966
DeKamp, J.C., *See* Zeller, A.F., 14:36917
Dekusar, V.M., *See* Artem'ev, N.I., 14:36074
Delafield, H.J., Neutron spectrometry measurements with large volume cylindrical proton-recoil counters developed for use in radiological protection, 14:37099 (R;GB)
Delahoy, A.E., Research on stable, high-efficiency, large-area, amorphous-silicon-based submodules, Task B: Semiannual subcontract report, 16 March 1988–15 September 1988, 14:35914 (R;US)
Delashmutt, L., *See* Hashemi, S., 14:36007
Delayen, J.R., *See* Bohn, C.L., 14:36954
Della Negra, S., Experiments on secondary ion emission with multicharged keV ion bombardement, 14:37471 (R;FR)
Dellinger, D., *See* Stinton, D.P., 14:35961
DeLuca, W.H., Accelerated life evaluation of valve-regulated lead-acid batteries, 14:36221 (R;US)
Delvin, W.L., ASTM C-26 committee and standards development, 14:35745 (R;US)
Dem'yanov, V.G., *See* Borisov, A.D., 14:37039
Demin, V.E., *See* Bystrov, V.M., 14:37080
Deming, E.J., *See* Hoffman, F.O., 14:37203
Demskij, M.I. and others, *See* Vakhrushin, Yu.P., 14:37087
Dengler, D., Microbiological investigations on nitrification in waste water treatment plants with fixed sludge beds. Pt. 2. Pilot scale test. Final report, 14:35903 (R;DE;In German)
Denisova, T.A., *See* Maksimova, L.G., 14:36768
Dennis, B.S., Hanford Environmental Dose Reconstruction Project: Monthly report, 14:37382 (R;US)
Dennis, G.E., Use of small scale ART processing for wellhead viscosity reduction and upgrading of heavy oils, 14:35712 (RA;CA)
Denniston, C., *See* Abrahamson, S., 14:37380
Dente, M., *See* Corti, A., 14:35717
Depauw, J., *See* Della Negra, S., 14:37471
Deplante, E.V., A symbolic generator of state equations for modeling of dynamic systems based on the electrical network analog paradigm, 14:37014 (R;US)
Depner, J.P., *See* Freeman, H.D., 14:35802
Derepovskij, V.N., *See* Belej, A.S., 14:37037
Dergachev, M.B., Relationships of structural to thermodynamic properties of sodium-cesium melts, 14:36556 (RA;SU;In Russian)
Derrer, Y.E., Developing a systematic approach to team training for emergency response personnel, 14:36135 (RA;US)
Deschamps, P., *See* Grosman, A., 14:37760
DesCourieres, T., *See* Peries, J.P., 14:35636
Desjarlais, M.P., *See* Hussey, T.W., 14:37483
See Stinnett, R.W., 14:37780
Desrochers, G., Power line fault probabilities, 14:35971 (R;CA)
Dessel, E.L. van, *See* Giovannelli, F., 14:37434
Destler, W.W., *See* Booske, J.H., 14:36961
Deutsch, L., *See* Varsamis, G., 14:37756
Deutscher, G., *See* Kresin, V.Z., 14:36654
DeVan, J.H., Sulfidation/oxidation properties of iron-based alloys containing niobium and aluminum, 14:35539 (R;US)
Devaty, R.P., Far- and mid-infrared properties of metal-insulator composite materials. Annual letter report, 1 January-31 December 1988, 14:36658 (R;US)
DeVault, R.C., [Working meeting of the International Energy Agency Annex 14 on Working fluids and transport phenomena in advanced absorption heat pumps, May 28-30, 1989, Stockholm, Sweden; May 31, 1989, Nykoping, Sweden; June 5, 1989, Stuttgart, West Germany; June 6, 1989, Essen, West Germany; June 7, 1989, Munich, West Germany]: Foreign trip report, 14:36389 (R;US)
Devgun, J.S., Implementation of an integrated CERCLA-NEPA environmental process at a FUSRAP site, 14:37226 (R;US)
Devineni, P., *See* Bunger, J.W., 14:35706
Devred, A., General formulas for the adiabatic propagation velocity of the normal zone, 14:36926 (J;US)
DeWitt, J.S., *See* Berrens, R.P., 14:37399
Di Ciaccio, A., *See* Goodman, M.S., 14:37124
Di Leonardo, R., *See* Restuccia, G., 14:36211
Di Massa, G., Beam position monitor analysis, 14:37068 (R;US)
Diamond, L., Community energy planner, 14:36255 (R;CA)
DiBella, F., Open cycle heat pump development: Phase II, District heating case study analysis: Progress report, October 1988–December 31, 1988, 14:36424 (R;US)
Dickerson, B., *See* Lederer, C.C., 14:36427
Dickey, F.M., *See* Stalker, K.T., 14:37020
Dickinson, W., Thermal completions for radial production systems, 14:35625 (RA;CA)
Ultrashort radius radial system. A new drilling and completion method for rapid development of oil sands reservoirs, 14:35609 (RA;CA)
Didenko, L.A., *See* Baldin, A.M., 14:37632
Diebold, G., *See* Barnes, P.D., 14:37503, 14:37505
See Hertzog, D.W., 14:37504
Diegle, R.B., *See* Helfand, M.A., 14:36366
Dienes, M., *See* Month, M., 14:37026, 14:37027
DiGregorio, D.E., *See* Pouliot, J., 14:37599
Dimov, G.I., AMBAL-YU experiment, 14:37725 (RA;SU;In Russian)
Dini, J.W., Developments and trends in electrodeposition, 14:36605 (J;US)
Dinterman, R.E., *See* Robinson, N.A., 14:37328
Dirkov, I.V., Methods of power distribution determination using the signals from out-of-pile detectors, 14:36108 (RA;SU;In Russian)
Ditmire, T., *See* Ruchti, R., 14:37109
Dittmer, J.O., *See* Benecke, M.W., 14:35759
See Pitner, A.L., 14:36036
Divine, J.R., *See* Bruemmer, S.M., 14:36601
Diwan, M.V., *See* Abe, K., 14:37499
Djalali, C., *See* Marty, N., 14:37630
Djumauradov, B., *See* Korpusov, G.V., 14:36843
Djurle, S., The Studsvik Super-Ramp Project: Quarterly progress report, April–June, 1982, 14:35999 (R;SE)
The Studsvik Super-Ramp Project: Quarterly progress report, July–September, 1982, 14:36000 (R;SE)
DM2 Collaboration, *See* Augustin, J.E., 14:37571
See Couchot, F., 14:37553
Doane, M.J., Derivation of service values from surveys, 14:36293 (RA;US)
Dobos, C.J., *See* Coubrough, L.E., 14:35688
Dobscha, F.X., *See* Boyer, C.M., 14:35681
Dodd, R.H. Jr., *See* Wellman, G.W., 14:36602
Dodelet, J.P., *See* Ladouceur, M, 14:36643
Doerner, R., *See* Toburen, L.H., 14:37663
Dolgachev, G.I., *See* Golovanov, Yu.P., 14:37767
Dolgirev, E.I., Calibration and testing of the DMG gamma dosimeter, 14:37111 (RA;SU;In Russian)
Dolgov, A.D., The cosmological constant problem, 14:37438 (R;US)
Doll, G.L., *See* Hoffman, D.M., 14:36696
Doll, J.D., *See* Northby, J.A., 14:37697
Domanski, R., *See* Reimann, J., 14:36981
Domanski, T., *See* Chruscielewski, W., 14:35597
Domenico, W.F., Guidelines for quality records in electronic media for nuclear facilities (NCIG-10): Final report, 14:36047 (R;US)
Domingo, J., *See* Barnes, P.D., 14:37496
Donaldson, K., *See* Love, R.G., 14:37191
Donovan, L.A., High temperature flood injury of woody swamp seedlings, 14:35916 (J;US)
Dooley, M., *See* Zeman, G.H., 14:37098
Doolittle, G., *See* O'Meara, J., 14:36942
Dorfan, J.M., Z^0 physics at the SLC, 14:37513 (R;US)
Dorina, T.A., *See* Poloskov, S.I., 14:36562
Dorning, R.E. II, A review of the Model 5A uranium hexafluoride cylinder, 14:35769 (R;US)
Dorricott, J., Production of ERW L80 for enhanced recovery wells, 14:36471 (RA;CA)
DosSantos, D.I., *See* Bohn, C.L., 14:36954
Dosser, L.R., Investigation of ambient and high temperature aging of PETN [pentaerythritol tetranitrate] by laser induced fluorescence and ultraviolet absorption spectroscopies, 14:37152 (R;US)
Dover, C. B., *See* Koch, P., 14:37638
Dowdle, L.D., OSLO project update and upgrader technology selection, 14:35729 (RA;CA)

Doyle, B.L., *See* Walsh, D.S., 14:37777
Dracos, M., *See* Arnold, R., 14:37101
Dragani, T.A., *See* Weinstein, I.B., 14:37389
Dragon, L., *See* Awes, T.C., 14:37562
See Plasil, F., 14:37597
Drain, D., AMPHORA detector, 14:37116 (R;FR)
Dreicer, J.S., Los Alamos Center for Computer Security formal computer security model, 14:37807 (R;US)
Dreike, P.L., Development of the BOLVAPS [Boil-Off Lithium VAPor Source] lithium vapor source for the PBFA-II [Particle Beam Fusion Accelerator II] accelerator, 14:37775 (R;US)
Dressler, K., Benefits offered by an advanced US-technique in describing faults (ALOK), 14:36991 (RA;DE;In German)
Drimmie, R.J., *See* Stempvoort, D.R. van, 14:37237
Drits, M.E., Neutron diffraction study of crystal structure of K_2Sn_3, Rb_2Sn_3, and Cs_2Sn_3, 14:36547 (RA;SU;In Russian)
See Potemkin, V.F., 14:36548
Drost, M.K., Review of second law analysis techniques applicable to the Energy Conversion and Utilization Technologies Thermal Sciences Program, 14:36226 (R;US)
Drouillard, T.F., A comprehensive guide to the literature on acoustic emission from composites: Supplement 2, 14:36994 (R;US)
Drozdova, M.K., *See* Torgov, V.G., 14:36863
Dryuchko, A.G., *See* Shevchuk, V.G., 14:36781
du Plessis, H.W., Effects of road condition on the operating costs of buses, 14:36406 (R;ZA)
Effects of road-surface properties on the fuel consumption of trucks and buses, 14:36405 (R;ZA)
Du, C.Kh., *See* Zhou, Z.X., 14:36823
Dubinsky, Z., *See* Berner, T., 14:37253
DuBois, D., Caviton dynamics in strong Langmuir turbulence, 14:37457 (R;US)
DuBois, R.D., *See* Manson, S.T., 14:37462
Dubovik, V.M., *See* Vinitskij, S.I., 14:37705
Duchene, G., *See* Vivien, J.P., 14:37586
Duerksen, J.H., Simulation of HASDrive UTF pilot, 14:35693 (RA;CA)
Duff, M.J., *See* Bergshoeff, E., 14:37700
Duffalt, R., *See* Genevey, J., 14:37581
Dufresne, J., Some aspects of the research and development programmes on the behaviour of containments during severe accidents, 14:36131 (R;FR)
Duhamel, G., *See* Langevin-Joliot, H., 14:37588
Duka-Zolyomy, A., *See* Bogdzel', A.A., 14:37604
See Gundorin, N.A., 14:37634
Dukovich, M., *See* Greene, W.C., 14:37329
Dumas, R.A., Investigation of the production of nitric oxide by soft solar x rays in the e-region of the ionosphere. Master's thesis, 14:37449 (R;US)
Dumitrescu, O., Enlarged superfluid model of atomic nucleus, 14:37609 (R;XA)
Dunaeva, T.I., *See* Il'yasov, I.I., 14:36791, 14:36792
Duncan, D.A., Water chemistry/water discharge relationships within the Churchill River diversion and Lake Winnipeg regulation region, Manitoba, Canada, 14:35895 (R;CA)
Dunn, C.P., *See* Scott, M.L., 14:37214
Dunn, W.E., *See* Spulak, R.G. Jr., 14:36195
Dunwoodie, W.M., *See* Kramer, G., 14:37119
Dunwoody, W.E., *See* Farrar, C.R., 14:36091
Duong, H.T., *See* Le Blanc, F., 14:37592
Dupont, P.J., Characterization of radioactive long-lived dust present in uranium mines and mills atmospheres, 14:35750 (RA;CA)
Dupuis, M.C., International co-operation in the field of operational safety, 14:36130 (R;FR)
Durai-Swamy, K., *See* Mansour, M.N., 14:35582
Durand, B., *See* Barger, V., 14:37491
Durand, L., *See* Barger, V., 14:37491
Durell, S.E.A.leV. dit, *See* Goss-Custard, J.D., 14:35945
Durkin, A.P., *See* Vladimirova, L.V., 14:37060
Durkin, L.S., *See* Abe, K., 14:37499
Dusan, B., *See* Gabriela, B., 14:37238
Dusseault, M.B, The development of shear strength in sludge/clay shale mixes for oil sands tailings disposal, 14:35738 (RA;CA)
Dusseault, M.B., Shear dilatency and permeability enhancement in oil sands, 14:35735 (RA;CA)
Dutty, W., *See* Barnes, P.D., 14:37503, 14:37505
See Hertzog, D.W., 14:37504
Dyabilin, K.S., To the problem of thermal stability of a stellarator reactor, 14:37764 (RA;SU;In Russian)
Dycus, D.L., Plankton studies at Sequoyah Nuclear Plant in 1988, 14:36111 (R;US)
Dyer, C.S., Particle transport simulation for spaceborne, NaI gamma-ray spectrometers, 14:37129 (R;GB)
Dytczak, M., Analysis and theoretical design of central solar heating plant with seasonal storage in Poland, 14:35934 (RA;CA;In English and French)
Dyunin, A.G., *See* Papikyan, S.Kh., 14:36761
Dzeranova, K.B., Fusion phase diagram of the system BiI_3-KI, 14:36797 (RA;SU;In Russian)
See Kaloev, N.I., 14:36796
Dziewulski, D.M., *See* Belfort, G., 14:35858
Dzyuba, E.D., *See* Malashonok, I.E., 14:36752

E

Eager, R.L., *See* Pepper, J.M., 14:35862
Eagleson, D.M., *See* Zeman, G.H., 14:37098
Eaton, R.P., *See* Ward, K.J., 14:37300
Ebeling, D.R., *See* Carlson, R.W.S., 14:36119
Eberhardt, H., *See* Dengler, D., 14:35903
Eckert, C.A., Supercritical fluid thermodynamics for coal processing: Quarterly progress report, September 15, 1988–December 31, 1988, 14:35529 (R;US)
Eckstein, J.N., High-temperature superconductivity. Quarterly report No. 1 for period ending FY89, 14:36613 (R;US)
Edelman, G.M., Performance based training for quality surveillance personnel, 14:36058 (RA;US)
Eden, J.G., Spectroscopy of absorbers in rare gas-halide laser plasmas, 14:36968 (BA;US)
Edmonds, C.G., *See* Loo, J.A., 14:36846
See Smith, R.D., 14:37143, 14:37475
Edmunds, N.R., Analysis and implementation of the steam assisted gravity drainage process at the AOSTRA UTF, 14:35708 (RA;CA)
Edmunds, W.A., Attenution of acidity in groundwater flow systems, 14:37260 (RA;NO)
Edson, J.L., *See* Ware, A.G., 14:36144
Edstroem, J.E., *See* Niswander, L., 14:37314
Edwards, R.I., Drum centrifuge modelling of long-term pollutant migration through a soil layer, 14:37222 (R;GB)
Edwardson, E., *See* Duport, P.J., 14:35750
Eeken, J.C.J., *See* Sobels, F.H., 14:37341
Efanov, V.A., *See* Belousov, A.N., 14:36566
Efimov, K.M., Some mathematical aspects of creation of the control system for a physical installation. Analytical review, 14:37076 (R;SU;In Russian)
Efimova, T.E., *See* Efimov, K.M., 14:37076
Egorov, A.V., *See* Zakharov, N.A., 14:36809
Egorov, N.P., Regularities of structure and properties of mixed oxides of the composition $ABTeO_6$ (A-K, Rb, Cs, Tl; B-Nb, Ta, Sb), 14:36795 (RA;SU;In Russian)
Ehgartner, B.L., A synopsis of analyses (1981–87) performed to assess the stability of underground excavations at Yucca Mountain: Yucca Mountain Project, 14:35808 (R;US)
Ehhalt, D.H., *See* Schubert, B., 14:37171
Ehksperiandova, L.P., *See* Blank, A.B., 14:36712
Ehleringer, J.R., Ecophysiology and adaptation in desert shrubs: Final report, 14:37206 (R;US)
Eichelberger, J.C., Research drilling in young silicic volcanoes, 14:37413 (R;US)
See Rundle, J.B., 14:37412
Eichinger, D., *See* Boeke, J.D., 14:37310
Eichten, E., *See* Lane, K., 14:37539
Eilers, D.L., *See* Darnell, R.A., 14:35851
Eilers, J.M., *See* Brakke, D.F., 14:37267
Eimerl, D., Thermal fracture in selected nonlinear optical materials, 14:36682 (BA;US)
See Davis, L.E., 14:37781
Einhorn, M., *See* Barnes, P.D., 14:37496

Einwohner, T.H., A MACSYMA package for the generation and manipulation of Chebyshev series, 14:37813 (R;US)
Eischens, R.P., Infrared study of carbon deposits on catalysts, 14:36736 (R;US)
Eisenhut, W., Determining the density distribution in a 7 metre coke oven, 14:35535 (R;XE;In German)
Eisenstein, R.A., *See* Barnes, P.D., 14:37503, 14:37505
See Hertzog, D.W., 14:37504
Eklund, A., *See* Awes, T.C., 14:37562
Eklund, P.C., *See* Hoffman, D.M., 14:36696
El-Kateb, S., *See* Watson, J. W., 14:37579
Eldrup, M., Implementation of computer programmes for fitting of positron annihilation spectra on "personal computers". Final report for the period 1 May 1986 - 14 June 1988, 14:37468 (R;XA)
Elgert, B.D., Cold Lake artificial lift optimization, 14:35630 (RA;CA)
Eliason, J.R., *See* Thiessen, R.L., 14:37404
Elizarov, L.I., *See* Antipov, S.P., 14:37768
Elkajbaji, M., *See* Thibault-Desseaux, J., 14:36496
Ellefson, R.E., *See* Tackett, J.R., 14:37140
Ellerbeck, R., *See* Walker, N., 14:37187
Elliott, D.S., Non-linear optical interactions involving the real Gaussian field: Annual technical progress report, August 1, 1986–July 31, 1989, 14:37134 (R;US)
Ellis, J., *See* Ruchti, R., 14:37109
Ellis, J.F., *See* Lue, J.W., 14:36929
Elphic, R.C., Magnetopause structure and dynamics: Issues for GEM [geospace environment modeling], 14:37456 (R;US)
Elssner, G., *See* Suga, T., 14:37675
Emanuel, W.R., [Workshop on global vegetation models, Laxenburg, Austria, 3 June–9 August 1988]: Foreign trip report, 14:37174 (R;US)
Embrechts, M.J., *See* Varsamis, G., 14:37756
Emery, M.S., *See* Britton, C.L. Jr., 14:37000
Emin, D., Formation, motion and high temperature superconductivity of large bipolarons, 14:37698 (R;US)
Emrich, M.L., *See* Johnson, M.L., 14:37820
Emsallem, A., *See* Genevey, J., 14:37581
Enbody, D.M., Analysis of existing advanced data models and their applicability as a model for a multimedia data-base management system. Master's thesis, 14:37817 (R;US)
Endries, J.M., Electricity pricing: a new role for an old concept, 14:36278 (RA;US)
Engel, D.C., Attributes of simplicity in pricing, 14:36322 (RA;US)
Engelbrecht, A.D., Report on the combustion of screened duff coal in a chain-grate stoker-fired boiler, 14:35590 (R;ZA)
Engelmore, R.S., *See* Feigenbaum, E.A., 14:37795
Engler, N.H., *See* Niemann, R.C., 14:36922
Englund, J.O., *See* Lydersen, E., 14:37263
Ensslin, N., Development of neutron multiplicity counters for safeguards assay, 14:35790 (R;US)
Enstroem, H., Uppsala heat pump. Evaluation of a district heating heatpump abstracting heat from sewage effluents, 14:36421 (R;SE;In Swedish)
Eppolito, P., Working systems from off-the-shelf components, 14:36300 (RA;US)
Erazmus, B., Heavy ions reactions below 100 MeV per nucleon: two contributions to the study of subthreshold pion production, 14:37601 (R;FR;In French)
Erb, U., *See* Shirokoff, J., 14:36621
Erck, R.A., *See* Cheng, C.C., 14:36472
See Erdemir, A., 14:36478
Erdemir, A., Ion-assisted deposition of silver films on ceramics for friction and wear control, 14:36478 (R;US)
Ericson, M.N., *See* Britton, C.L., 14:37798
See Britton, C.L. Jr., 14:37000
Ericsson, G., *See* Barnes, P.D., 14:37503, 14:37505
See Hertzog, D.W., 14:37504
Eriksson, E., Alkalinity production in soil and rock: A useful concept for understanding acidification of soil and freshwater, 14:37259 (RA;NO)
Erkkila, B.H., Unique applications of tamper indicating devices, 14:35840 (R;US)
Erlandson, A.C., *See* Murray, J.E., 14:37782
Erno, B.P., The role of combustion gases in recovering oil in in-situ combustion processes, 14:35629 (RA;CA)
Ernst, D.J., *See* Bottcher, C., 14:37498
Ershov, E.B., Units for detecting surface contamination by alpha radionuclides, 14:37113 (RA;SU;In Russian)
Erwin, A., *See* Barger, V., 14:37491
Eser, Semih, Thermal stability of jet fuel: Second quarterly report, January–March 1989, 14:35643 (R;US)
Espy, J., *See* Glasser, W.J., 14:36059
Eto, J., *See* Seppanen, O., 14:36386
Evan, R.J., Liquid fuels from the pyrolysis of municipal solid waste and its components, 14:36442 (BA;US)
Evans, E.P., Reliability estimates for large satellite memories in low earth orbits, 14:37002 (R;US)
Evans, R.G, New oil sands conservation regulations for Alberta, 14:35744 (RA;CA)
Evans, R.G., Oil sands project application. Review process-mediation, not confrontation, 14:35743 (RA;CA)
Even, F., *See* Portfors, E., 14:35870
Evseeva, N.K., *See* Korpusov, G.V., 14:36820
Eyrich, W., *See* Barnes, P.D., 14:37503, 14:37505
See Hertzog, D.W., 14:37504
Ezhela, V.V., *See* Alekhin, S.I., 14:37518

F

Fabricius, J., Pressure-dependent melting curve of natural carnallite, $KMgCl_3.6H_2O$, in a closed system, where evaporation is prevented, 14:37416 (R;DK)
Fagan, J., Exploring new dimensions in RTP, 14:36302 (RA;US)
Fahli, A., Transition between phenomena governed by the mean field and those governed by nucleon-nucleon collisions in the reaction $^{40}Ar + ^{68}Zn$, 14:37580 (R;FR;In French)
Failor, R.A., Kinetics of the gas phase tritium oxidation reaction, 14:36849 (R;US)
Fairbank, W.M. Jr., Detection of photon bursts from single 200 eV Mg ions: Progress in photon burst mass spectrometry, 14:37139 (R;US)
Fairlie, D.B., *See* Zachos, C.K., 14:37545
Faison, B.D., *See* Davison, B.H., 14:35519
Fakeev, A.A., Investigation into deep purification processes of potassium, rubidium and cesium dihydrophosphates, 14:36811 (RA;SU;In Russian)
See Ryabenko, E.A., 14:36805
See Volkov, A.I., 14:36757
Falk, R.S., Effect of a diesel blend containing heavy naphtha on the performance and durability of an ADE 236 diesel engine operating with standard-injection timing, 14:36446 (R;ZA)
Effect of a light-diesel blend formulated by BP on the performance and durability of an ADE 314 diesel engine, 14:36445 (R;ZA)
Engine operation on extended diesel fuels, 14:36444 (R;ZA)
Falkowski, P.G., *See* Berner, T., 14:37253
Falomo, R., *See* Treves, A., 14:37431
Fan, L.-S., *See* Tewksbury, T.L., 14:35532
Fan, N.Q., Nuclear magnetic resonance with dc SQUID preamplifiers, 14:36905 (J;US)
Fanning, T.G., *See* Singer, M.F., 14:37288
Farbtukh, T.A., *See* Liberman, A.N., 14:37654
Farias, C.C., *See* Nobrega Coutinho, P. da, 14:37208
Farkas, B.K., *See* Anderson, G.R., 14:37388
Farmer, J.W., Pressure-dependent DLTS experiments on Si-doped AlGaAs, 14:36700 (BA;US)
Farouq Ali, S.M., Oil sands formation preheating study, 14:35714 (RA;CA)
See Lozada, D., 14:35603
Farrar, C.R., Static load cycle testing of a low-aspect-ratio six-inch wall TRG-type structure TRG-4-6 (1.0, 0.25), 14:36091 (R;US)
Farrar, L.C., *See* Rosa, R.J., 14:36352
See Solbes, A., 14:36355
Farris, W.T., *See* Kennedy, W.E., Jr., 14:35785
Faruquil, A., Comparison of time-of-use rate impacts, 14:36334 (RA;US)
Fast, R.W., SSC detector solenoid, 14:36925 (J;US)

Fateman, R.J., *See* Einwohner, T.H., 14:37813
Faucheux, G., *See* Vergnaud, T., 14:37156
Faure, J.P., High resolution electron microscopy studies of the atomic structure of interfaces in magnetic sandwiches, 14:36494 (BA;FR)
Faustova, R.S., *See* Savenkova, M.A., 14:36755
Fawcett, D.H., *See* Finnegan, D.J., 14:37311
Fawcett-Long, J., *See* Moore, C., 14:36162
Fawkes, P., Small hydro in Canada, 1988, 14:35874 (RA;CA)
Fay, W., *See* Lorenz, R., 14:37255
Fazio, M.V., *See* Vorthman, J.E., 14:37008
Fecht, H.J., Contribution of lattice matching to the interfacial energy between dissimilar materials, 14:36622 (BA;FR)
See Lojkowski, W., 14:36517
Fedoroff, N., Regulation of the maize suppressor-mutator element, 14:37287 (RA;US)
Fedorov, A.E., *See* Melkumyants, M.V., 14:36773
Fedorov, Yu.S., *See* Zilberman, B.Ya., 14:36718
Fedyakin, P.N., *See* Zakharov, Yu.V., 14:36567
Feesh, A.A., *See* Semrad, E.E., 14:36772
Feigenbaum, E.A., Expert systems on multiprocessor architectures. Phase 1. Final report, March 1985-July 1987, 14:37795 (R;US)
Feigenbutz, L.V., *See* Benecke, M.W., 14:35759
Feldman, D., Progress report for a research program in theoretical high energy physics, 14:37493 (R;US)
Fenech, M., Micronuclei: an important end-point in radiation biology, 14:37351 (RA;AU)
Feng Jiawu., *See* Li Panyu, 14:35753
Fenske, G.R., *See* Cheng, C.C., 14:36472
See Erdemir, A., 14:36478
Ferguson, M., *See* Marsh, P., 14:37234
Ferland, G., *See* Starrfield, S., 14:37437
Ferrari, C., *See* Faure, J.P., 14:36494
Ferrari, M.J., Flux noise and flux creep in YBCO thin films, 14:36897 (J;US)
Ferrier, R.C., *See* Langan, S.J., 14:37261
Feshbach, H., *See* Barnes, P.D., 14:37496
Fessler, R.R., Threshold-stress determination using tapered specimens and cyclic stresses, 14:35685 (BA;US)
Feuston, B.P., Fragmentation and structure of silicon microclusters, 14:37691 (BA;US)
Feygin, M., Laser based machine for die and prototype manufacturing: Final report, February 10, 1987–August 9, 1988, 14:36870 (R;US)
Fiala, C., *See* Kulak, R.F., 14:36142
Fidel'man, B.M., *See* Zolotovitskaya, Eh.S., 14:36711
Fieguth, T., *See* Toge, N., 14:37095
Fieguth, T.H., *See* Haiessinski, J., 14:37066
Field, C., *See* Bowden, G., 14:37126
Fields, D.J., Heavy ion reaction studies of Nb_Au at E/A = 50, 75 and 100 MeV, 14:37600 (J;NL)
Fields, S.M., *See* Udseth, H.R., 14:37142
Fietz, W.A., *See* Lue, J.W., 14:36929
Figueira, J.F., *See* Harris, D.B., 14:37770
Figueredo, C., *See* Machado, P., 14:35710
Figuerola, E., Extraction of zinc(2), cadmium(2), copper(2) and iron(3) by cyanex 272, 14:36840 (RA;SU)
Filin, R.D., Comparison of mathematical models of non-equilibrium boiling for calculation of non-stationary processes, 14:36980 (RA;SU;In Russian)
Filippov, E.A., *See* Laskorin, B.N., 14:36858
Filippov, V.K., *See* Nokhrin, V.I., 14:36798
Fimushkin, V.V., *See* Kulikov, M.V., 14:37086
Finger, J.T., PDC [polycrystalline diamond compact] bit research at Sandia National Laboratories, 14:35943 (R;US)
Fink, G.R., *See* Boeke, J.D., 14:37310
Finley, S.J., Characterization and implications of dickite-mineralized fractures in Mesaverde core from Piceance Creek basin, 14:35673 (J;US)
See Lorenz, J.C., 14:35602
Finn, J., *See* Booske, J.H., 14:36961
Finnegan, D.J., Structure of mutations induced by I-R hybrid dysgenesis in Drosophila melanogaster, 14:37311 (RA;US)
Finnie, I., *See* Riddle, R.A., 14:36597
Fionov, A.A., *See* Bol'shakov, V.I., 14:36017
Fiore, E.M., In situ high-temperature cross-sectional TEM specimen preparation, 14:36651 (BA;US)
Firer, A.A., *See* Andreev, B.M., 14:36814
First, M.W., Proceedings of the 20th DOE/NRC nuclear air cleaning conference: Sessions 1–5, 14:37200 (R;US)
Proceedings of the 20th DOE/NRC nuclear air cleaning conference: Sessions 6–15, 14:37201 (R;US)
Fischer, C., *See* Bagreev, V.V., 14:36716
Fischer, H., *See* Barnes, P.D., 14:37505
Fischer, J.E., Staging in layer intercalates: Progress report, 1 June 1988–31 May 1989, 14:36667 (R;US)
Fischer, R.A., Nonlinear optical beam manipulation, beam combining, and atmospheric propagation, 14:36967 (B;US)
Fischer, W., Non-proliferation regime, vertical proliferation and the interests of the Federal Republic of Germany, 14:36247 (R;DE;In German)
Fischmeister, H.F., *See* Maurer, R., 14:36515
Fisher, J.E., Application of generic PRA insights to NRC inspection, 14:36181 (BA;DE)
Fisher, J.R., *See* Mueller, J.R., 14:36066
Fisk, W.J., *See* Seppanen, O., 14:36386
Fisk, Z., *See* Hammel, P.C., 14:36640
See Takigawa, M., 14:36641
See Takigawa, Masashi, 14:36642
Fitzgerald, R.J., Implementing requirements for radiation worker training from DOE Order 5480.11, 14:35754 (R;US)
Fitzpatrick, R., *See* Chu Tsonglun, 14:36176, 14:36178
Fitzsimmons, M.R., X-ray diffraction studies of the structure and properties of grain boundaries, 14:36485 (BA;FR)
Flaim, S.J., *See* Gaines, L.L., 14:35864
Flaim, T., Innovative pricing: do benefits outweigh costs?, 14:36297 (RA;US)
Flannery, G., Radiation sensitivity of human natural killer cells recognising bone marrow targets, 14:37352 (RA;AU)
Fleissner, J.G., TRIFID [TRansuranic Isotopic Fraction Interrogation Device]: A second generation plutonium isotopic analysis system, 14:35843 (R;US)
Flyckt, D.L., *See* Sommer, D.J., 14:35815
Flynn, C.P., Metastable ordered compounds formed during epitaxial growth, 14:36539 (BA;FR)
Flynn, G.J., Synchrotron x-ray fluorescence analyses of stratospheric cosmic dust: New results for chondritic and nickel-depleted particles, 14:37425 (R;US)
Fodor, E., *See* Culea, M, 14:37469
Foerster, B., Investigation about the usefulness of Landsat 5 thematic mapper data for mapping forest disease, 14:37160 (R;DE;In German)
Folles, S.M., *See* Baskes, M.I., 14:36514
Fokin, G.D., Increasing of effeciency and quality of electron beam welding of zirconium alloys by using and additional vacuum chamber, 14:36561 (RA;SU;In Russian)
Foley, W.J., Closeout of IE Bulletin 80-09: Hydramotor actuator deficiencies, 14:36164 (R;US)
See Dean, R.S., 14:35841
Folga, S., *See* Lyczkowski, R.W., 14:35580
Follansbee, P.S., The response of single crystal and polycrystal nickel to quasistatic and shock deformation, 14:36573 (R;US)
Fomichev, V.V., *See* Poloznikova, M.Eh., 14:36763
See Proskuryakova, E.V., 14:36759
See Slivko, T.A., 14:36789
Fomin, V.A., *See* Mozgovoj, A.G., 14:36554
Foner, S., *See* Coffey, K.R., 14:36944
See Pourrahimi, S., 14:36941
Fontana, M.H., DOE advanced reactor severe accident program (ARSAP) - an overview, 14:36180 (BA;DE)
Foote, G.S., *See* Newton, J.O., 14:37606
Forbes, J.M., Global density specification in the lower thermosphere. Final report, 15 June 1985-17 June 1988, 14:37448 (R;US)
Ford, J.K.B., Distribution, abundance and age segregation of bowhead whales in the southeast Beaufort Sea, August-September 1986, 14:35661 (R;CA)
Forest, E., Canonical integration and analysis of periodic maps using non-standard analysis and life methods, 14:37709 (R;US)

Forsythe, R., *See* Babu, M., 14:35958
Fortier, S., *See* Langevin-Joliot, H., 14:37588
Foster, I., *See* Butler, R., 14:37285
Foster, N.W., *See* Nicolson, J.A., 14:37262
Fotiev, A.A., *See* Surat, L.L., 14:36801
Fouquet, D., Marginal cost pricing in France, 14:36336 (RA;US)
Fourcade, N., Dynamic approach to the implementation of the optimization principles in uranium mines, 14:35749 (RA;CA)
Fournelle, R.A., Diffusion induced grain boundary migration in Ni(Zn) polycrystals, 14:36523 (BA;FR)
Fowler, C.M., Disk generator with nearly shockless accelerated driver plate, 14:37010 (R;US)
The Mark IX generator, 14:37004 (R;US)
See Freeman, B.L., 14:37090
See Goforth, J.H., 14:37734
See Reinovsky, R.E., 14:37013
See Rickel, D.G., 14:37011
See Vorthman, J.E., 14:37008
Fowler, D.L., *See* Hill, J., 14:37249
Fowler, M., *See* Alcorn, J., 14:36943
See O'Meara, J., 14:36942
Francis, C.E., An annual storage ice system for summer cooling, 14:36209 (RA;CA;In English and French)
Francis, M., Andhi Khola Hydel and Rural Electrification Project (AHREP) Nepal. Low cost hydropower with maximum local training, 14:35871 (RA;CA)
Franck, P.A., Optimization of a combined heat pump/storage system with solar or convective heat collectors, 14:36382 (RA;CA;In English and French)
Frank, M.L., *See* Hoffman, F.O., 14:37203
Frank, R.N., A review of the development of a program to generate inspection programs for the OGP [Optical Gaging Products] optical CMM [Coordinate Measuring Machine], 14:37147 (R;US)
Frankiw, K.E., *See* Wong, A., 14:35624
Frantzis, L., *See* Windingland, L.M., 14:36252
Fraval, F.D., Planning techniques for intercity transportation services. Final report, 14:36407 (R;US)
Frazier, J.L., *See* Henson, H.M., 14:35777
Frear, D.R., *See* Schmale, D.T., 14:36585
See Tribula, D., 14:36574
Fredholm, M., *See* Wilson, M.C., 14:37292
Freeman, B.L., High-voltage pulsed transformer development, 14:37009 (R;US)
The Mark 101 flux compression generator: Development progress, 14:37090 (R;US)
See Oona, H., 14:37473
See Rickel, D.G., 14:37011
Freeman, D.L., *See* Northby, J.A., 14:37697
Freeman, H.D., Technology assessment guide for application of engineered sorbent barriers to low-level radioactive waste disposal sites, 14:35802 (R;US)
Freeman, R.M., Origin of the $^{13}C + {}^{17}O$ resonant structure, 14:37576 (R;FR)
Freemont, P.S., *See* Steitz, T.A., 14:37297
Frehaut, J., *See* Jahnke, U., 14:37603
Freier, D.A., *See* Fleissner, J.G., 14:35843
Freiesleben, H., *See* Heusch, B., 14:37587
Frejdovich, I.A., *See* Bystrov, V.M., 14:37080
Frejus Collaboration, *See* Bourdarios, G., 14:37707
See Longuemare, C., 14:37706
Frekers, D., *See* Watson, J. W., 14:37579
Frenkel', P.L., Determination of specific heats of double magnesium and alkali metal orthophosphates, 14:36753 (RA;SU;In Russian)
See Lyutsko, V.A., 14:36749
Frenkel, D., *See* Ladd, A.J.C., 14:37488
Frick, F.A., *See* Murray, J.E., 14:37782
Fridman, A.S., *See* Drits, M.E., 14:36547
See Zusman, L.L., 14:36552
Fried, H.M., *See* Feldman, D., 14:37493
Friedlander, E.M., *See* Carruthers, P., 14:37540
Friedman, J.I., *See* Womersley, W.J., 14:37122
Friedman, J.M., *See* Steitz, T.A., 14:37297
Friedrich, F.D., *See* Razbin, V.V., 14:35587, 14:37022
Fritz, P., *See* Stempvoort, D.R. van, 14:37237
Fritz, T.L., *See* Davis, G.D., 14:36461
Froehlich, D., Hydropower plant modernization guide: Volume 3, Automation: Final report, 14:35875 (R;US)
Froeschen, W., Leaching of vitrified high-level-active-waste in a near reality simulated repository system. Final report, 14:35789 (R;DE;In German)
Froster, F., *See* Keller, H.M., 14:37245
Fry, R.J.M., Risk assessment and late effects of radiation in low-earth orbits, 14:37343 (R;US)
Fry, W., *See* Barger, V., 14:37491
Frye, J.M., *See* Schauer, M.W., 14:36650
Fu, C.Y., Approximation of precompound effects in Hauser-Feshbach codes for calculating double differential (n, xn) cross sections, 14:37637 (J;US)
Fuchs, H., *See* Rivet, M.F., 14:37578
Fuerstenau, D.W., Surface properties of coal and their role in coal beneficiation: Technical progress report, March 15, 1989–June 14, 1989, 14:35557 (R;US)
Fuess, S., *See* Womersley, W.J., 14:37122
Fujii, T.K., *See* Miura, S., 14:36524
Fujiwara, M., *See* Suganami, T., 14:36390
Fukuda, Kousaku., *See* Namba, Takashi, 14:36022
Fukumoto, S., *See* Alton, G.D., 14:37467
Fukushima, Hiroto, Charged particle activation analysis of light elements, 14:36721 (RA;JP;In Japanese)
Fulkerson, W., Energy technology R and D: What could make a difference?: A study by the staff of the Oak Ridge National Laboratory: Part 1, Synthesis report: Volume 1, 14:36245 (R;US)
Fulton, J.L., *See* Smith, R.D., 14:35644
Funk, G., Coal-fired MHD topping cycle test progress at the component development and integration facility, 14:36350 (BA;US)
Fussell, J.B., PRISIM - A computer program that enhances operational safety, 14:35983 (RA;XA)

G

Gaalema, S., *See* Kramer, G., 14:37119
Gabriel, T.A., *See* Goodman, M.S., 14:37124
Gabriels, B., Quality of surface water evolution during snowmelt. International symposium on acidification and water pathways, 14:37238 (RA;NO)
Gabutti, A., Superconducting detector for minimum ionizing particles, 14:37123 (J;NL)
Gaden, E.L. Jr., *See* Scott, C.D., 14:35905
Gadioli, E., Generalised exciton model theories for the description of pre-equilibrium angular distributions, 14:37620 (R;IT)
Gagnon, C., *See* Desrochers, G., 14:35971
Gaines, L.L., Cost goals for biofuels technologies, 14:35864 (BA;US)
Galabova, G., *See* Hadjiev, D., 14:36838
Galaktionov, S.V., *See* Bystrov, V.M., 14:37080
Galas, C.M.F., *See* McGee, B.C.W., 14:35711
Gale, R.M., *See* Katayama, Y.B., 14:35803
Gales, S., *See* Langevin-Joliot, H., 14:37588
Galiano, M.L., Vertical gradient freeze GaAs: Growth and electrical properties, 14:36576 (R;US)
Galiasso, R., Syncrude processing in conventional refineries, 14:35704 (RA;CA)
Gallagher, J.S., *See* Starrfield, S., 14:37437
Gallant, W.D., *See* Aston, T.R.C., 14:35567, 14:35568
Gallichand, J., *See* Vigneault, C., 14:36415
Galloway, J.N., *See* Moody, J.L., 14:37165
Galonsky, A., *See* Marty, N., 14:37630
Gamache, R.R., *See* Reinisch, B.W., 14:37452
Gamalij, E.G., Effect of electron distribution function inhomogeneity on heat transfer in a laser-produced plasma, 14:37727 (RA;SU;In Russian)
Gamo, Kenji, Focused ion beam processing, 14:35853 (RA;JP;In Japanese)
Ganotis, G.L., *See* Goodzeit, C.L., 14:36911
Garber, D.P., *See* Lappin, A.R., 14:35811
Garber, M., The effect of self field on the critical current determination of multifilamentary superconductors, 14:36936 (J;US)
See Ghosh, A.K., 14:36933

See Maix, R.K., 14:36919
See Sampson, W.B., 14:36946
See Wanderer, P., 14:36908
Garbet, X., Turbulence and abnormal transport in tokamak plasmas, 14:37718 (R;FR;In French)
Garcia, B., *See* Henslee, S.P., 14:35846
Gard, G.L., Improved acid electrolytes: synthesis and structure of fluorine-containing sulfonic acids for fuel cells. Final report, July 1987-August 1988, 14:36363 (R;US)
Gardes, D., *See* Rivet, M.F., 14:37578
Gardner, R.F., *See* Helin, F.J., 14:35987
Gardner, R.H., Comparative analysis of broad-scale landscape patterns, 14:37211 (J;US)
Garland, T.R., *See* Cataldo, D.A., 14:37233
Garner, F.A., *See* Russell, K.C., 14:36580
Garrard, W.N., Introduction to lithium batteries. General document, 14:36220 (R;AU)
Garrels, J.I., *See* Lambert, M.E., 14:37387
Garrett, H.E., Explorations of mechanisms regulating ectomycorrhizal colonization of boron-fertilized pine: Quarterly report, April 1,1989–June 30, 1989, 14:35901 (R;US)
Garrett, W.R., Saturation behavior of parametric four-wave mixing due to two-photon interference effect, 14:37465 (R;US)
Garrison, J.D., Development of a carbonaceous selective absorber for solar thermal energy collection and process for its formation: Final report, 14:35929 (R;US)
Garwin, *See* Missert, N., 14:36955
Gass, V.F., *See* Val'dner, O.A., 14:37038
Gateff, E., Retrovirus-like particles, reoviruses, and c-src expression in malignant tumors of Drosophila melanogaster, 14:37296 (RA;US)
Gatens, J.M., *See* Murtha, J.A., 14:35676
Gau, J.S., *See* Ho, H.M., 14:36685
Gautesen, A.K., *See* Chambers, D.H., 14:37486
Gauthier, E., *See* Grosman, A., 14:37760
Gauvin, H., *See* Anne, R., 14:37682
See Herault, J., 14:37573
See Rivet, M.F., 14:37578
Gavalya, A., *See* Tuzel, W., 14:36937
Gawlak, M., *See* Ignasiak, B., 14:35547
Gay, D.W., *See* Murphy, C.E. Jr., 14:35921
Gayen, S.K., *See* Petricevic, V., 14:36959
Gaynor, W., *See* Graves, K., 14:37803
Gear, C.W., *See* Aslam, S., 14:37802
Geballe, T.H., *See* Missert, N., 14:36955
Gehringer, C., *See* Vivien, J.P., 14:37586
Gejst, A.G., *See* Mazitov, R.K., 14:36802
Gelinas, R., Perspectives on land modelling. Workshop proceedings, 14:36235 (R;CA)
Genevey, J., Decay of new mass-separated neutron-deficient La and Ce isotopes, 14:37581 (R;FR)
George, A.E., *See* Coskuner, G., 14:35726
Georgiev, P.G., *See* Tchurikov, N.A., 14:37307
Georgieva, S.G., *See* Tchurikov, N.A., 14:37307
Geraci, C.L., Testing of hair dryers for asbestos emissions, 14:37180 (R;US)
Gerasimova, T.I., *See* Tchurikov, N.A., 14:37307
Gerberich, W.W., Metallurgical aspects of crack-tip failure processes, 14:36590 (BA;US)
Gerlic, E., *See* Langevin-Joliot, H., 14:37588
German, R.M., Microstructural refinement of W-Ni-Fe heavy alloys by alloying additions, 14:36462 (R;US)
Gerold, V., *See* Mueller, M., 14:36986
See Niegel, A., 14:36987
Gerstle, F.P., *See* Dreike, P.L., 14:37775
Gerstle, F.P. Jr., *See* Wood, J.D., 14:36586
Getmanov, B.S., Classification of integrable two-dimensional models of relativistic field theory by means of computer, 14:37552 (R;SU;In Russian)
Geyer, P.K., Molecular basis of transposable element-induced mutations in Drosophila melanogaster, 14:37308 (RA;US)
Ghanem, E.S., *See* Singer, C.E., 14:37740
Ghendrih, P., Plugging regime in the pump limiter throat, 14:37719 (R;FR)
Ghodbane, S., Study of the separation of two overlapping compounds in preparative liquid chromatography, 14:36852 (BA;US)
Ghosh, A., *See* Wanderer, P., 14:36908
Ghosh, A.K., Training in test samples of superconducting cables for accelerator magnets, 14:36933 (J;US)
See Garber, M., 14:36936
See Sampson, W.B., 14:36946
Giacomelli, G.F., *See* Miller, R.L., 14:35641
Giakupian, B., *See* Fournelle, R.A., 14:36523
Gibbard, B.G., *See* Abe, K., 14:37499
Gibbon, G.A., Evaluation of an on-line gas chromatographic system, 14:35545 (BA;US)
Gibbs, W.S., *See* Carter, D.H., 14:36638
Gibson, C.R., Structural characteristics of proposed ITER TF coil conductor, 14:36930 (J;US)
Gibson, E.D., *See* No, K., 14:36947
Giddings, A.E., *See* Hass, K.J., 14:37130
Gierszewski, P., *See* Varsamis, G., 14:37756
Gilbert, E., *See* Abrahamson, S., 14:37380
Gilbert, W.S., Magnetic field decay in model SSC dipoles, 14:36913 (J;US)
Giles, M.S., Outline of the proposed radioecology study at the Maralinga Weapons Test site, 14:37643 (RA;AU)
Gill, R.J., *See* Berman, C.H., 14:35687
Gillman, R.A., Experiences with a large load research project in the Pacific Northwest: ELCAP [End-Use Load and Consumer Assessment Program], 14:36340 (R;US)
Gilman, F.J., CP violation in K decays, 14:37533 (R;US)
Heavy quark physics, 14:37532 (R;US)
Gilman, R.A., *See* Young, L., 14:37572
Gilmozzi, R., *See* Sanz Fernandez de Cordoba, L., 14:37429
Gilpin, L.L., Evaluation of the advanced mixed oxide fuel test FO-2 irradiated in Fast Flux Test Facility, 14:36037 (R;US)
Ginley, D.S., *See* Martens, J.S., 14:36898, 14:36901
See Venturini, E.L., 14:36584, 14:36647
Giomataris, Y., *See* Arnold, R., 14:37101
Giorni, A., *See* Drain, D., 14:37116
Giovannelli, F., 0535+26/HDE 245770 - a typical Be/X-ray transient system: coordinated multiwavelength twelve years monitor, 14:37434 (RA;FR)
Gisler, G., Axisymmetric particle-in-cell simulations of diamagnetic-cavity formation in vacuum, 14:37784 (J;US)
Gizon, A., *See* Genevey, J., 14:37581
See Weiss, B., 14:37589
Gladysz, J.A., [Ligand intermediates in metalcatalyzed reactions]: Progress report, July 1, 1985–June 30, 1989, 14:36737 (R;US)
Glasser, A.H., The stability of the High-Density Z-Pinch, 14:37737 (R;US)
Glasser, W.J., Application of quality principles to training of QA audit personnel, 14:36059 (RA;US)
Glazkov, A.A. and others, *See* Val'dner, O.A., 14:37038
Gleiter, H., *See* Korn, D., 14:36541
Glick, J., *See* DiBella, F., 14:36424
Glish, G.L., *See* McLuckey, S.A., 14:37148
Gloe, K., *See* Aurich, J., 14:36832
Glovan, R.J., Status report of 1A test train hardware performance and development, 14:36356 (BA;US)
Glover, K.M., *See* Barrett, J.H., 14:37100
Glowienka, J.C., *See* Langley, R.A., 14:37758
Glowka, D.A., *See* Finger, J.T., 14:35943
Glushkov, E.S., ARADAR program abstract, 14:36078 (RA;SU;In Russian)
See Biryuk, G.I., 14:36030
Glynn, J.C., *See* Reilly, H.J., 14:36182
Goderre, G.P., Beam-beam interaction and pacman effects in the SSC with random nonlinear multipoles, 14:37050 (R;US)
Godfrey, P.J., Fiscal year 1987 program report (Massachusetts Water Resources Research Center). Annual report, 14:37280 (R;US)
Goebel, C., *See* Barger, V., 14:37491
Goes, A.G.A., *See* Guimaraes, A.C.F., 14:36132
Goett, A.A., Effects of voluntary TOU rates on revenues, 14:36315 (RA;US)
Goforth, J.H., Design of an explosive pulsed power system for driving 16-MA plasma flow switch experiments, 14:37734 (R;US)

Explosively formed fuse opening switches for use in flux-compression generator circuits, 14:37007 (R;US)
See Reinovsky, R.E., 14:37013
Golant, V.E., *See* Askinazi, L.G., 14:37723
Golden, M., Enhanced CP violations in hadronic charm decays, 14:37542 (J;NL)
Goldfarb, V., *See* Hemsath, K.H., 14:36419
Goldman, C., Least-cost planning in the utility sector: Progress and challenges, 14:36338 (R;US)
Golomski, K.H., Improvement of work safety and strain reduction when equipping thin faces through the development and testing of a turning and swinging installation for shield support units. Final report, 14:35596 (R;DE;In German)
Golovanov, V.I., Low-coverned nature of association (micellation) of dialkylphosphates in water and organic phases and their manifestation in the process of metal extraction with dialkylphosphoric acid, 14:36829 (RA;SU)
Golovanov, Yu.P., Plasma circuit breaker in a magnetic field as a high-power ion flux generator, 14:37767 (RA;SU;In Russian)
Golovin, I.N., Neutron generator based on adiabatic trap, 14:37769 (RA;SU;In Russian)
Golovkin, B.G., Phase composition in the system $LiVO_3$-TiO_2-$V_2O_5(V_2O_4)$, 14:36777 (RA;SU;In Russian)
Golubev, V.N., *See* Lazoryak, V.I., 14:36756
Gomez, I., *See* Chacin, E., 14:35617
Gomez, M.T., Temporal variations of solar-spectral-line profiles induced by the 5-minute photospheric oscillation, 14:37422 (R;US)
Gomin, E.A., Use of the Monte Carlo method for verification of the accuracy of modern methods for heterogeneous reactor calculations, 14:36076 (RA;SU;In Russian)
Gonczy, J.D., *See* Niemann, R.C., 14:36922
Good, R.J., Fundamental research on surface science of coal in support of physical beneficiation of coal: Quarterly technical progress report, January 1–March 31, 1989, 14:35551 (R;US)
Goodman, L.J., *See* Zeman, G.H., 14:37098
Goodman, M.C., *See* Womersley, W.J., 14:37122
Goodman, M.S., Sources of compensation in hadronic calorimeters, 14:37124 (J;NL)
Goodrich, L.F., Current capacity degradation in superconducting cable strands, 14:36940 (J;US)
Goodwin, G.M., The Sigmajig: An improved hot-cracking test, 14:36479 (R;US)
Goodzeit, C., *See* Wanderer, P., 14:36908
Goodzeit, C.L., Measurement of internal forces in superconducting accelerator magnets with strain gauge transducers, 14:36911 (J;US)
Gorbunov, A.I., *See* Zajtsev, S.A., 14:36817
Gorbunov, V.P., Information retrieval system of nuclear fuel account for in-situ on-line control system of NPP with RBMK reactors, 14:37818 (RA;SU;In Russian)
Gordon, J.A., *See* Brown, R.T., 14:35899
Gordon, M.A., *See* Band, D.L., 14:37446
Gore, M.L., *See* Jarrell, D.B., 14:36166
Goretta, K.C., *See* King, W.E., 14:36607
Gorobunov, V.P., Automation of confidence control for the initial measured data at in-situ level of on-line control system at NPPs with RBMK reactors, 14:36105 (RA;SU;In Russian)
Gorozhanin, D.V., *See* Ivanov, B.I., 14:37059
Goryachenko, V.D., Systems with aftereffect in nuclear reactor dynamics, 14:36070 (RA;SU;In Russian)
Gosnell, T.R., Optical pumping of vibrational overtones in KI:CN-infrared lasers, 14:36957 (R;US)
Goss-Custard, J.D., Prediction of post barrage densities of shorebirds. V. 4. Birds, 14:35945 (R;GB)
Goulden, P.D., *See* Neilson, M.A., 14:37257
Goulding, R.H., *See* Langley, R.A., 14:37758
Gouveia, A.H.C., Deformations in structure of the scapolites from northeast, Brazil, 14:36708 (R;BR;In Portuguese)
Goyal, A., Coal-test program in a pressurized, fluidized-bed ash-agglomerating process development unit. Volume 2. Data analysis. Final report, November 15, 1984-August 31, 1987, 14:35544 (R;US)
Grabski, M.W., Mobility of dislocations in grain boundaries, 14:37673 (BA;FR)
See Lejcek, P., 14:36522
Graham, E.K., *See* Eimerl, D., 14:36682
Graham, R.A., *See* Venturini, E.L., 14:36647
Graham, R.L., Evaluating spatial patterns of forest productivity in a disturbed, mountainous landscape using LANDSAT data and a GIS, 14:37338 (J;US)
See Iverson, L.R., 14:35923
Graham, R.V., *See* Hoffman, F.O., 14:37203
Grahame, D.A., *See* Stadman, T.C., 14:35860
Granatstein, V.L., *See* Booske, J.H., 14:36961
Grand Accelerateur Natio, *See* Suraud, E., 14:37762
Granovsky, J.A., *See* Spilrain, E.E., 14:35605
Gransell, H., Development of and outlook for cogeneration in the United States, 14:36251 (RA;US)
Grant, B.C., *See* McLuckey, S.A., 14:37148
Grasser, T., *See* Rochau, G.E., 14:37774
Grassi, I., *See* Perucca, J.C., 14:37403
Gratta, G., *See* Adolphsen, C., 14:37096
Graves, K., User's guide to CONVEST, 14:37803 (R;US)
Gray, G.T. III, *See* Follansbee, P.S., 14:36573
Gray, K.E., *See* Gabutti, A., 14:37123
See Kang, J.H., 14:36950
See Romano, P., 14:36956
Gray, L.G.S., Corrosion problems and experience at AOSTRA in-situ thermal recovery pilots, 14:36468 (RA;CA)
Greben, J.M., Nucleon as a color magnetic soliton, 14:37621 (RA;ZA)
Grechko, N.Yu., *See* Melkumyants, M.V., 14:36773
Grecu, D., Contribution of the kink-kink interaction to the free energy of a complex scalar nonlinear field, 14:37550 (RA;RO;In Romanian)
Greegor, R.B., X-ray absorption spectroscopy investigations of high Tc superconductors, 14:36649 (BA;US)
Green, A., *See* Berry, J.A., 14:37224
Green, D.J., *See* Mills, A.W., 14:36470
Green, M.A., *See* Gilbert, W.S., 14:36913
See Pope, W.L., 14:36923
Green, M.I., *See* Gilbert, W.S., 14:36913
Green, M.M., Mobile DNA elements and spontaneous gene mutation, 14:37305 (RA;US)
See Geyer, P.K., 14:37308
Green, S.M., Bi-Ca-Sr-Cu-O superconductors, 14:36953 (J;US)
Greene, A., *See* Wanderer, P., 14:36908
Greene, A.E., Calculational evaluation of plasma flow switches for the Los Alamos Foil Implosion Project, 14:37003 (R;US)
See Bowers, R.L., 14:37012
See Goforth, J.H., 14:37734
Greene, B.R., Couplings in the heterotic superconformal three generation model, 14:37529 (R;DK)
Greene, W.C., HTLV-I, HIV, and human T cell growth, 14:37329 (RA;US)
Greenwell, J, *See* Haston, J.A., 14:35721
Greenwell, J.I., *See* Reed, R.P., 14:36891
Gregg, R.E., *See* Fisher, J.E., 14:36181
Gregoire, C., *See* Rivet, M.F., 14:37472
See Suraud, E., 14:37608, 14:37762
Gregory, E., A conductor, with uncoupled 2.5 μm. diameter filaments, designed for the outer cable of SSC dipole magnets, 14:36938 (J;US)
Grieco, J., *See* Singh, S., 14:35707
Griffin, R.C., *See* Marland, G., 14:37173
Griffiths, P.R., Spectroscopic study of coal structure and reactivity: Quarterly report, January 1, 1989 to March 31, 1989, 14:35552 (R;US)
Grimes, B.K., *See* Bush, L.L., 14:36052
Grimson, J.H., *See* Fast, R.W., 14:36925
Grimsrud, D.T., *See* Seppanen, O., 14:36386
Grinstein, B., $B^- \to X_s e^+ e^-$ in the six-quark model, 14:37538 (J;NL)
See Golden, M., 14:37542
Grishechkina, S.P., Permittivity relaxation in $Pb_{1-x}Ge_xTe$, 14:36558 (RA;SU;In Russian)
Grishin, V.G., *See* Baldin, A.M., 14:37632
Grivas, D., *See* Tribula, D., 14:36574
Grivaz, J.F., Neutrino counting in single photon experiments, 14:37509 (R;FR)

Groenemeyer, D.H., New possibilities and aspects of NMR diagnosis by ultralow field NMR imaging, 14:37317 (RA;DD;In German)
Groenewold, G.H., *See* Hassett, D.J., 14:37217
Gromov, V.V., *See* Krutyakov, A.N., 14:36636, 14:36637
See Kuranov, K.E., 14:36790
See Kurilenko, L.I., 14:36769
Gronsky, R., *See* Csencsits, R., 14:36688
See Siegel, R.W., 14:36534
Gropp, W., CFD (computational fluid dynamics) research for minisupercomputers: a Yale/UTRC program. Final report, 15 February 1987-14 October 1988, 14:37478 (R;US)
Grosman, A., Tore Supra first wall description and behaviour during the initial plasma experiments, 14:37760 (R;FR)
See Ghendrih, P., 14:37719
Gross, F., CEBAF/SURA 1984 summer workshop: Proceedings, 14:37031 (R;US)
CEBAF/SURA 1986 summer workshop: Proceedings, 14:37569 (R;US)
CEBAF/SURA [Continuous Electron Beam Accelerator Facility]/[Southeastern Universities Research Association] 1988 summer workshop: Proceedings, 14:37566 (R;US)
CEBAF/SURA [Continuous Electron Beam Accelerator Facility]/[Southeastern Universities Research Association] 1987 summer workshop: Proceedings, 14:37567 (R;US)
Grossman, W., *See* Reich, M., 14:36129
Grove, A., Cold flow modeling study of coal-fired MHD combustor, 14:36360 (BA;US)
Grudzevich, O.T., Consistent systematics of nuclear level densities for mean and heavy nuclei, 14:37612 (RA;XA)
See Bychkov, V.M., 14:37618
Gruen, D.M., *See* Schauer, M.W., 14:36650
Gryaznevich, M.P., *See* Askinazi, L.G., 14:37723
Guang-Xian Xu, *See* Chun-Hui Huang, 14:36826
Guarnieri, A., *See* Giovannelli, F., 14:37434
Gudiksen, P.H., Field studies for determining the characteristics and dynamics of local circulations, 14:37164 (R;US)
Gudintseva, Eh.N., *See* Fakeev, A.A., 14:36811
Gudladt, H.J., *See* Niegel, A., 14:36987
Guemrah, F., Steam-CO_2 injection to recover heavy oil in limestones, 14:35608 (RA;CA)
Guenther, P.T., *See* Chiba, S., 14:37585
See Smith, A.B., 14:37614
Guenther, S., *See* Cooley, R.A., 14:36042
Guillope, M., *See* Larere, A., 14:36509
Guillot, J., *See* Langevin-Joliot, H., 14:37588
Guimaraes, A.C.F., Use of source term code package in the ELEBRA MX-850 system, 14:36132 (R;BR;In Portuguese)
Guin, J.A., Configurational diffusion of coal macromolecules: Quarterly progress report, March 16–June 15, 1989, 14:35556 (R;US)
See Curtis, C.W., 14:35526
Guiochon, G., *See* Ghodbane, S., 14:36852
See Katti, A.M., 14:36732
See Schudel, J.V.H., 14:36730
Guirao, C.M., A summary of hydrogen-air detonation experiments, 14:36161 (R;US)
Gukova, Yu.Ya., Comparative analysis of rubidium, cesium-potassium, sodium state diagrams using photometry, 14:36549 (RA;SU;In Russian)
Evaluation of rubidium, cesium - tin, antimony state diagrams, 14:36550 (RA;SU;In Russian)
On photometric studies of rubidium cesium - transition metal systems, 14:36551 (RA;SU;In Russian)
Gul'bin, V.V., Diffusion at explosion welding of titanium with steel, 14:36568 (RA;SU;In Russian)
Gundorin, N.A., Analysis of dynamic characteristics of ^{235}U fission with resonance neutrons on the basis of data on fission fragment charge and mass fragmentation, 14:37634 (R;SU;In Russian)
See Bogdzel', A.A., 14:37604
Gunn, D.W., *See* Kutzak, A.R., 14:35724
Gunn, J.M., *See* Lumatainen, V.A., 14:37391
Gunnink, R., Program listings for GRPANL: A suite of computer programs for analyzing complex Ge and alpha-particle detector spectra: Volume 3, 14:37120 (R;US)
Gunter, R., A recuperative gas fired forge furnace, 14:37023 (R;US)
Gunther, T.M., *See* White, B.A., 14:36237
Gur, T.M., *See* Ahn, B.T., 14:36652
Guralnik, G.S., Progress report for a research program in computational physics, 14:37492 (R;US)
Gusev, E.V., *See* Belej, A.S., 14:37037
Gusev, M.L., *See* Andreev, V.A., 14:37083
Gust, W., *See* Fournelle, R.A., 14:36523
Gutbrod, H.H., Plastic Ball experiments, 14:37110 (R;DE)
Guthrie, S.A., *See* Serot, D.E., 14:35654
Guyon, L., *See* Drain, D., 14:37116
Guyonnet, J.L., *See* Arnold, R., 14:37101
Guzhovskij, B.Ya., *See* Zvenigorodskij, A.G., 14:37610

H

Haaland, D.M., *See* Ward, K.J., 14:37300
Haas, B., *See* Vivien, J.P., 14:37586
Haas, F., Beam transmission in MP equipment. New measurements. Main effects and application to VIVITRON, 14:37071 (R;FR;In French)
See Freeman, R.M., 14:37576
Haas, M.R., Site selection for GRI (Gas Research Institute) cooperative tight-gas field research. Volume 1: screening of candidate tight gas formations. Topical report, May-July 1988, 14:35672 (R;US)
Haasz, A.A., Review of synergisms in materials erosion due to multispecies impact, 14:37755 (R;CA)
Hachem, A., *See* Freeman, R.M., 14:37576
Hackett, E.M., *See* Joyce, J.A., 14:36579
Hackett, J., *See* Gibbon, G.A., 14:35545
Hadjiev, D., Some possibilities for improvement of the extraction properties in mixed extraction systems, 14:36838 (RA;SU)
Hadjipanayis, G.C., *See* Sellmyer, D.J., 14:36483
Hadley, G.R., *See* Smith, A.V., 14:36974
Hadlock, D.E., *See* Scherpelz, R.I., 14:37662
Hadorn, J.C., The Vaulruz project experimental results, 14:35933 (RA;CA;In English and French)
Hagan, C.W. Jr., *See* Fulkerson, W., 14:36245
Hagege, S., HVEM and HREM of interfaces in aluminum nitride ceramics, 14:36624 (BA;FR)
Haggag, F.M., Estimating fracture toughness using tension or ball indentation tests and a modified critical strain model, 14:36475 (R;US)
Precracking and computerized single-specimen J_{Ic} determination for irradiated three-point bend specimens, 14:36172 (BA;US)
Structural integrity evaluation based on an innovative field indentation microprobe, 14:36984 (R;US)
Hahale, N.K., *See* Newberger, B., 14:37049
Hahn, E.L., *See* Fan, N.Q., 14:36905
Hahn, F., *See* Abrahamson, S., 14:37380
Hahn, H., *See* Siegel, R.W., 14:36534
Hahn, S., Effects of carbon concentration upon oxygen precipitation in Cz Si, 14:36694 (BA;US)
Hahne, E., *See* Bugaj, A.H., 14:36217
Hai Guo, *See* Chun-Hui Huang, 14:36826
Haiessinski, J., PHASEFIX: Correcting the tunes of the SLC Arcs, 14:37066 (R;US)
See Toge, N., 14:37095
Haight, R., *See* Ho, P.S., 14:36668
Hajek, B.K., Relating quality at work to quality at home, 14:35755 (RA;US)
Hakkila, E.A., Application of process monitoring to verify facility design, 14:35839 (R;US)
Halbleib, J.A., *See* Sanford, T.W.L., 14:37092
Hale, J.R., *See* Marston, P.G., 14:36918
Hall Reno, M., *See* Arnold, P.B., 14:37536
Hall, E.S., *See* Sengupta, S., 14:35716
Hall, L.J., Cosmic relics from the big bang, 14:37440 (R;US)
Hallam, R.J., *See* McGee, B.C.W., 14:35711
Hallensleben, Y., *See* Galiasso, R., 14:35704
Haller, E.E., *See* Nolte, D.D., 14:36697
Hallquist, J.O., DYNA3D user's manual: (Nonlinear dynamic analysis of structures in three dimensions): Revision 5, 14:36893 (R;US)

Halzen, F., *See* Barger, V., 14:37491
Hamel, W.R., *See* Wehe, D.K., 14:37816
Hamet, J.F., *See* Bary, A., 14:36673
Hamilton, K.E., Energy analysis of Canadian external trade, 1971 and 1976, 14:36227 (R;CA;In English and French)
Hamlin, D.A., *See* Lowen, R.W., 14:37154
Hammel, C.P., *See* Takigawa, Masashi, 14:36642
Hammel, J., The high density z-pinch II experiment, 14:37735 (R;US)
Hammel, P.C., Nuclear relaxation rates at copper and oxygen sites in $YBa_2Cu_3O_7$, 14:36640 (R;US)
See Takigawa, M., 14:36641
Hammon, H.G., *See* Warren, F.T., 14:36882
Hammond, N.D.A., *See* Dyer, C.S., 14:37129
Hammond, R., *See* Missert, N., 14:36955
Hammond, R.H., *See* Ferrari, M.J., 14:36897
See Rosenthal, P., 14:36900
Hampshire, D.P., The critical density throughout the superconducting phase of multifilamentary Nb_3Sn wire for forced flow fusion applications measured using the Bean-Campbell AC magnetization technique, 14:36951 (J;US)
Hamrick, T.P., *See* Laughlin, D.L., 14:36125
Handwerker, C.A., Equilibrium crystal shapes and surface phase diagrams at surfaces in ceramics, 14:36631 (BA;FR)
See Vaudin, M.D., 14:36535
Hanft, R., *See* Strait, J., 14:36912
Hanft, R.W., Studies of time dependence of fields in Tevatron superconducting dipole magnets, 14:36921 (J;US)
See Herrup, D.A., 14:36920
Hanna, W.B., *See* O'Neill, H.J., 14:37219
Hannachi, F., *See* Bourgeois, C., 14:37591, 14:37593
Hansen, D.P., Strategies to meet increased competition, 14:36291 (RA;US)
Hansen, H.J., PFMS [Precision Flexible Manufacturing System] tool characterization study at Lawrence Livermore National Laboratory, 14:36587 (R;US)
Hansen, J., *See* Kelkar, S., 14:35680
Hansen, L.F., *See* Fields, D.J., 14:37600
Hansen, W.L., *See* Chin, D.K., 14:36899
See Li, M.F., 14:36699
Hanser, P., Cost-based pricing in the United States, 14:36335 (RA;US)
Introduction: demand-side management – a fundamental part of utility planning, 14:36324 (RA;US)
New dimensions in marginal cost concepts, 14.36279 (RA;US)
Hanson, P.J., *See* Taylor, G.E. Jr., 14:37397
Happer, W., Physics of spin-polarized atomic vapors. Final report, 1 October 1986-30 April 1988, 14:37461 (R;US)
Hardesty, D.R., Coal combustion science: Quarterly progress report, January–March 1989, 14:35592 (R;US)
Harding, D.J., Automatic steering corrections to minimize injection oscillations in the Fermilab Antiproton Source rings, 14:37074 (R;US)
Hardy, J.E., *See* Carnal, C.L., 14:35763
Haridoss, S., *See* Crine, J.-P., 14:36728
Harmon, B.A., *See* Pouliot, J., 14:37599
Harrington, D.K., Lessons learned from three years of operator team skills training, 14:36044 (RA;US)
Harris, D.B., KrF lasers for inertial confinement fusion, 14:37770 (R;US)
Harris, J.D., *See* Minarick, J.W., 14:36173
Harris, R.A., *See* Knutson, B.J., 14:36034
Harrison, R., *See* du Plessis, H.W., 14:36406
Harrison, S.A., *See* Interrante, G.C., 14:35820
Harrje, D.T., [International Energy Agency third experts meeting of Annex 20 on Airflow patterns within buildings, May 30–June 2, 1989, Aalborg, Denmark; June 1, Aalborg University, Denmark; June 5-6, Taastrup, Denmark]: Foreign trip report, 14:36388 (R;US)
Hart, A., *See* Funk, G., 14:36350
Hart, R.C., *See* Garrett, W.R., 14:37465
Hartlen, R.T., Vibration monitoring of main coolant pumps: Guideline and reference data: Final report, 14:36096 (R;US)
Hartmann, L.W., *See* Panek, R.J., 14:37436
Harunuzzaman, M., User's manual: GCOST: A gas cost-of-service program: Version 1.0, 14:36432 (R;US)
Harvey, A., *See* Cain, P., 14:35561
Harwood, L., *See* Alcorn, J., 14:36943
See Brindza, P., 14:36934
Harwood, L.H., A superconducting iron-dominated quadrupole for CEBAF, 14:36939 (J;US)
Hashemi, S., The plant expert system (PLEXSYS) development environment: System description and user's manual, version 2: Final report, 14:36007 (R;US)
Hashimoto, S., *See* Mimaki, T., 14:36536
See Miura, S., 14:36524
Hashino, Tasuke, Energy eigenvalues of helium-like atoms in dense plasmas, 14:37731 (R;JP)
Haslett, G.A., Technical note on the construction of stoppings or dams in the Sydney coalfield, 14:35574 (R;CA)
Hass, K.J., A radiation-hardened 16/32-bit microprocessor, 14:37130 (R;US)
Hassan, B., *See* Menlove, H.O., 14:35757
Hassenzahl, W., A comparison of the conductor requirements for energy storage devices made with ideal coil geometries, 14:36928 (J;US)
Considerations against a force compensated coil, 14:36935 (J;US)
Superconducting Magnetic Energy Storage, 14:36895 (J;US)
Hassett, D.J., Ion exchange and soil attenuation of Gulf Coast and Great Plains soils: Final report, 14:37217 (R;US)
Haston, J.A., AOSTRA underground test facility: mining access for research and production, 14:35721 (RA;CA)
See Edmunds, N.R., 14:35708
Hatanaka, G., *See* Reichman, J., 14:35974
Hatori, Tadatsugu, Long-time correlation for the chaotic orbit in the two-wave Hamiltonian, 14:37729 (R;JP)
Hauck, J.P., *See* Muller, C.H. III, 14:36973
Hauhs, M., Relation between water flow paths in the soil and runoff chemistry at Risdalsheia, a small headwater catchment in southern Norway, 14:37265 (RA;NO)
Haupt, W., *See* Reim, K., 14:35752
Hauschildt, H.E., A proposal of more expedient methods of testing machine tools, 14:36998 (R;US)
Hauser, S.G., *See* Gillman, R.A., 14:36340
Hausser, O., *See* Watson, J. W., 14:37579
Hausz, W., Thermal energy storage in the energy ecosystem, 14:36215 (RA;CA;In English and French)
Hauth, J., *See* Moore, C., 14:36162
Havener, C.C., [Electron-ion cross beam experiments and ion-atom collisions, Louvain-la-Neuve, Belgium, Paris, France, Utrecht, the Netherlands, and Groeningen, the Netherlands, April 30–May 28, 1989]: Foreign trip report, 14:37474 (R;US)
Hawkins, R.W., *See* Moschopedis, S.E., 14:35518
Hawley, M.C., *See* Rorrer, G.L., 14:35869
Hawrynski, M.J., Experimental verification of the theory of clusters, 14:36744 (RA;CA)
Haynam, C., *See* Comaskey, B., 14:36969
Haysam, J.C., The influence of termination configuration on the flow performance of flues, 14:37024 (R;CA)
Haysom, J.C., The influence of flue sharing on venting performance, 14:37025 (R;CA)
Hazard, H.R., *See* Chace, A.S., 14:36412
Heaney, M.B., *See* Fan, N.Q., 14:36905
Heap, M.P., *See* LaFond, J.F., 14:35591
Hechler, J., *See* Noel, D., 14:37172
Hedvig, P., Methods for studying effects of high-energy irradiation on the mechanical and electric properties of polymers, 14:36655 (R;TR)
Heffner, R.H., *See* Hammel, P.C., 14:36640
See Takigawa, M., 14:36641
See Takigawa, Masashi, 14:36642
Helfand, M.A., The nature and composition of the passive film formed on Ni-P-Cr metallic glasses, 14:36366 (BA;US)
Helin, F.J., Use of statistics to monitor quality in training, 14:35987 (RA:US)
Helm, F.H., *See* Simpson, R.L., 14:36847
Helmer, R., *See* Watson, J. W., 14:37579
Helton, J.C., *See* Leigh, C.D., 14:36188

Hemsath, K.H., Gas-based iron making: feasibility study. Final report, April 1985-December 1986, 14:36419 (R;US)
Henderson, R., *See* Watson, J. W., 14:37579
Hendriksz, P.J., Fabrication, pre-irradiation characterization and irradiation history of GE rods, for The Super-Ramp Project: The Studsvik Super-Ramp Project, 14:35998 (R;SE)
Hennick, A., *See* Dean, R.S., 14:35841
See Foley, W.J., 14:36164
Henning, C.D., Magnet systems for the international thermonuclear experimental reactor, 14:36909 (J;US)
Hennings, W., *See* Bongartz, R., 14:36157
Henriksen, A., *See* Norton, S.A., 14:37266
Henry, D.M., *See* Sattison, M.B., 14:36174
Henslee, S.P., Argonne Unified Safeguard: An integrated materials monitoring/tracking and accounting system, 14:35846 (R;US)
Henson, H.M., Monitoring of corrosion in ORGDP cylinder yards, 14:35777 (R;US)
Herault, J., Interaction of 20-100 MeV/u heavy ions with cold matter, 14:37573 (R;FR)
See Anne, R., 14:37682
Herbert, R., *See* Babu, M., 14:35958
Herman, M., *See* Reffo, G., 14:37611
Herrera, J., *See* Wanderer, P., 14:36908
Herriges, J., Marketing rates that enhance net revenue, 14:36313 (RA;US)
Herriges, J.A., *See* Caves, D.W., 14:36314
Herring, R.A., Depth-dependent character of extended defects in ion-implanted and RTA'd Si, 14:36690 (BA;US)
See Fiore, E.M., 14:36651
Herrmann, G., Discovery and confirmation of fission, 14:37602 (R;DE)
Herrup, D.A., Time variations of fields in superconducting magnets and their effects on accelerators, 14:36920 (J;US)
See Hanft, R.W., 14:36921
Herschitz, R., Atomic resolution observations of solute-atom segregation and two-dimensional phase transitions at internal interfaces, 14:36512 (BA;FR)
Hertzberg, V., *See* Abrahamson, S., 14:37380
Hertzog, D.W., Lambda-antilambda decay asymmetries and CP violation, 14:37504 (R;US)
Herwig, K.W., Density dependence of the momentum distribution in normal liquid ^{4}He, 14:37639 (R;US)
Heslop, L.A., Energy typologies. Energy expenditures of Canadians, 1969-1982, 14:36231 (R;CA;In French)
Hesse, K., *See* Niessen, H.F., 14:36024
Hesse, M., Parallel electric fields in a simulation of magnetotail reconnection and plasmoid evolution, 14:37455 (R;US)
Hetherington, C.J.D., Preparation of semiconductor cross sections by cleaving, 14:36686 (BA;US)
Heusch, B., Fast-fission component with small mass drift in the reaction ^{84}Kr + ^{27}Al at E_{Lab} = 5.9 MeV/u, 14:37587 (R;FR)
Hewlett, J., *See* Cantor, R., 14:36064
Hick, L., *See* Srajer, V., 14:35573
Higgins, J.C., Generic safety insights for inspection of boiling water reactors, 14:36179 (BA;DE)
Hildingsson, L., *See* Bourgeois, C., 14:37591
Hill, J., Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic): Blue crab, 14:37249 (R;US)
Hill, K.W., *See* Beiersdorfer, P., 14:37738
Hilleke, R.O., *See* Carpenter, J.M., 14:37097
Hilliard, R.K., Submerged gravel scrubber demonstration as a passive air cleaner for containment venting and purging with sodium aerosols—CSTF tests AC7–AC10, 14:36028 (R;US)
See McCormack, J.D., 14:36029
See Muhlestein, L.D., 14:36187
Hillman, B.M., *See* Fisher, J.E., 14:36181
Hillmann, B.M., *See* Higgins, J.C., 14:36179
Hillstroem, C.-G., *See* Brunstroem, C., 14:35935
Hilscher, D. and others, *See* Drain, D., 14:37116
Hindar, A., *See* Johannessen, M., 14:37246
Hinde, D.J., Mass-split dependence of the pre- and post-scission neutron multiplicities for fission of ^{251}Es, 14:37607 (R;AU)
See Newton, J.O., 14:37606
Hine, R.C., *See* Roman, C.P., 14:36040
Hinesly, T.D., *See* Skelton, L.W., 14:36433
Hinks, D.G., Evidence for phonon-mediated coupling in superconducting $Ba_{0.6}K_{0.4}BiO_3$, 14:36615 (R;US)
Hinton, M.F., *See* Fisher, J.E., 14:36181
Hirano, Kei-ichi, Homeostasis in plasma confinement at beta close to unity, 14:37728 (R;JP)
Hirao, Takashi, *See* Yoshida, Akihisa, 14:35854
Hirschon, A.S., Exploratory coprocessing research: Quarterly report number 2, for the period December 1, 1988 to February 28, 1989, 14:35527 (R;US)
Hirst, E., *See* Goldman, C., 14:36338
Hiser, A.L., Post-irradiation fracture toughness characterization of four lab-melt plates: Revision 1, 14:36578 (R;US)
Hitchon, B., *See* Perkins, E., 14:35739
Hjalmarson, H.P., *See* Farmer, J.W., 14:36700
Ho, H.M., Cross-sectioning magnetic thin films for TEM, 14:36685 (BA;US)
Ho, H.V., Radiation injuries of the intestine, treated in the Surgical Department of Wuerzburg University Hospital between 1974 and 1982, 14:37355 (R;DE;In German)
Ho, P.S., Chemistry and microstructure at metal-polymer interfaces, 14:36668 (BA;FR)
Hobbins, R.R., *See* Vinjamuri, K., 14:36192
Hobson, D.O., *See* Kennedy, C.R., 14:36663
Hodgdon, M.L., Applications of the computer codes FLUX2D and PHI3D for the electromagnetic analysis of compressed magnetic field generators and power flow channels, 14:37480 (R;US)
See Freeman, B.L., 14:37090
See Goforth, J.H., 14:37734
See Oona, H., 14:37473
Hodgson, P.E., Neutron optical model potential, 14:37615 (RA;XA)
Hoeberling, R.F., *See* Fowler, C.M., 14:37010
See Vorthman, J.E., 14:37008
Hoel, R.H., Structure of Ni/MgO interfaces, 14:36489 (BA;FR)
Hoenig, M.O., The design of a high field Ohmic heating coil for a superconducting tokamak, based on the US-DPC test coil, 14:36907 (J;US)
Hoernle, R.F.A., *See* Von Wimmersperg, U., 14:37622
Hoff, R.W., *See* Block, R.C., 14:37605
Hofferth, L.J., *See* Schumann, M., 14:37790
Hoffland, A.H., *See* Tallon, R.W., 14:36657
Hoffman, D.M., Optical reflectance studies of $C_{24}K$ and $C_{24}K(NH_3)$, 14:36696 (BA;US)
Hoffman, F.O., Pasture grass interception and retention of ^{131}I, ^{7}Be, and insoluble microspheres deposited in rain, 14:37203 (R;US)
[Radiological incidents, Tours, France, June 18–June 24, 1988]: Foreign trip report, 14:37334 (R;US)
See Blaylock, B.G., 14:37661
Hoffman, F.O. Jr., Priorities for the next decade of research in radiation ecology, 14:37385 (J;US)
Hoffman, M.Z., Study of intermediates from transition metal excited-state electron-transfer reactions: Progress report, August 1, 1986–December 31, 1988, 14:36741 (R;US)
Hoftun, J., *See* Cutts, D., 14:37028
Hoftun, J.S., *See* Barter, C., 14:37104
See Cutts, D., 14:37103, 14:37105, 14:37106
Hogan, R.E., Finite control volume modeling of laminar and turbulent flow of air in an enclosure, 14:37485 (R;US)
Hohenwarter, G.K.G., *See* Martens, J.S., 14:36898, 14:36901, 14:36904
Holden, W.A., *See* Patrilla, V., 14:36138
Holdt, H.-J., *See* Aurich, J., 14:36832
Holland, J.F., *See* Bauer, S.J., 14:35809
Holland, M., *See* Kelkar, S., 14:35680
Hollerbach, A., *See* Murtada, H., 14:35604
Hollo, E., Practical use of personal computer based methods for NPP operational safety assessment, 14:35979 (RA;XA)
Holm, A.V., *See* Panek, R.J., 14:37436
Holmes, D.S., Detection and characterization of novel metal-binding proteins: Final report, 14:37324 (R;US)
Holst, P., *See* Brunstroem, C., 14:35935
Holt, J.W., SRO supervisory skills, 14:36005 (RA;US)
Holt, R.J., *See* Young, L., 14:37572
Holtkamp, D.B., *See* Evans, E.P., 14:37002

Holton, L.K. Jr., *See* Katayama, Y.B., 14:35803
Hone, C., *See* O'Donovan, N., 14:35788, 14:37644
Hongbing Ding, *See* Jiufang Lu, 14:35765
Honkel, H., A computer model of the ZTH energy system at Los Alamos, 14:37749 (J;US)
Honnell, R.E., *See* Carter, D.H., 14:36638
Hoover, C.E., *See* Trujillo, A.A., 14:37791
Hopkins, C., *See* Murtha, J.A., 14:35676
Horan, J.T., Radionuclide distribution in TMI-2 reactor building basement liquids and solids, 14:36193 (BA;US)
See McIsaac, C.V., 14:36194
Horie, Misato, *See* Torata, Shin-ichiro, 14:35800
Horiuchi, R., *See* Minonishi, Y., 14:36531
Hornung, M., Increased acidity and aluminium concentration in streams following afforestation: Causative mechanisms and processes, 14:37243 (RA;NO)
Horoi, M., *See* Dumitrescu, O., 14:37609
Horton, J.A., Effect of chromium on early stages of oxidation of Ni_3Al alloys at 600°C, 14:36608 (J;US)
Horwitz, E.P., *See* Schulz, W.W., 14:35764
Hosker, R.P. Jr., *See* Gudiksen, P.H., 14:37164
Hosoya, Akio, Wormhole instanton solution in the Einstein-Yang-Mills system, 14:37445 (R;JP)
Hospelhorn, R.L., *See* Huffman, D.D., 14:37017
Hough, A., Compressive creep in nuclear oxides, 14:36614 (R;GB)
Houlberg, L.M., Environmental Regulatory Update Table, May 1989, 14:37220 (R;US)
Hovind, H., *See* Lydersen, E., 14:37263
Howard, W.M., *See* Meyer, B.S., 14:37636
Howarth, I.D., *See* Boyle, S.J., 14:37432
Howden, M.G., Conversion of methanol over zeolite ZSM-5, 14:35859 (R;ZA)
Howell, M., *See* DeVan, J.H., 14:35539
Howells, G.D., *See* Brown, D.J.A., 14:37244
Hsiao, W.L., *See* Weinstein, I.B., 14:37389
Hsieh, B.J., Comparison of analysis and vibration test results for a multiple supported piping system, 14:36143 (R;US)
Nonlinear behavior of a containment building during an earthquake, 14:36085 (R;US)
Hsieh, L., *See* Weinstein, I.B., 14:37389
Hsieh, T.E., *See* Balluffi, R.W., 14:36498
Hsu, H.S., *See* DeVan, J.H., 14:35539
Huang, S.F., *See* Marland, G., 14:37173
Hubert, F., *See* Anne, R., 14:37682
See Herault, J., 14:37573
Hudson, C.R. II, *See* Williams, K.A., 14:37808
Hudson, M.L., *See* Bartel, T.J., 14:36409
Huffman, D.D., Photocurrent variability of discrete bipolar devices, 14:37017 (R;US)
Huggins, R.A., *See* Ahn, B.T., 14:36652
Huhn, F., *See* Eisenhut, W., 14:35535
Hui, K.C., *See* Shirokoff, J., 14:36621
Hultqvist, B., Scientific results from the Swedish Viking satellite: A 1988 status report, 14:37454 (R;SE)
Hummer, C., *See* Rosing, M., 14:37070
Humphrey, A.E., *See* Scott, C.D., 14:35905
Humphreys, D.L., *See* Kincy, M.A., 14:36883
Humphreys, D.R., *See* Turman, B.N., 14:37773
Hundley, M.F., *See* Ott, K.C., 14:36639
Hunemuller, N.K., Simulation facility evaluation program, 14:36039 (RA;US)
Hunike, E.T., *See* Parr, B.F., 14:37189
Hunt, A.J., *See* Lofftus, K., 14:37251
See Quinby-Hunt, M.S., 14:37250
Hunt, M.S., NMERI (National Mechanical Engineering Research Institute) experience with alcohol fuels for diesel engines, 14:36451 (R;ZA)
Hunteman, W.J., Lessons learned in the DOE Computer Security Enhancement Review Program, 14:37805 (R;US)
See Dreicer, J.S., 14:37807
Hunter, R.L., *See* Lappin, A.R., 14:35811
Hunter, T., *See* Alcorn, J., 14:36943
Hurd, A.J., Scattering from fractals, 14:37690 (R;US)
Hurley, C.E., *See* Murray, J.E., 14:37782
Huson, F.R., *See* Newberger, B., 14:37049
See Swenson, C.A., 14:37034
See Tompkins, P.A., 14:37073
Hussey, T.W., MHD calculations of anode plasmas, 14:37483 (R;US)
See Roderick, N.F., 14:37742, 14:37743
Hutton, A., *See* Haiessinski, J., 14:37066
See Toge, N., 14:37095
Huyakorn, P.S., VAM2D–Variably saturated analysis model in two dimensions: Version 5.0 with hysteresis and chained decay transport: Documentation and user's guide, 14:35793 (R;US)
Hyndman, L.D., Legal framework for operation of government research and development agencies, 14:35690 (RA;CA)
Hyodo, Hiromi, *See* Matsuura, Kiyokata, 14:37804

I

Ichihashi, M., *See* Brown, J.K., 14:37350
Ichinose, H., *See* Ishida, Y., 14:36623
Idrissi, N., *See* Genevey, J., 14:37581
Ignasiak, B., Solubilization of coal by reductive and non-reductive alkylation in liquid ammonia, 14:35547 (RA;CA)
Ignatyuk, A.V., *See* Grudzevich, O.T., 14:37612
Ihlal, A., *See* Bary, A., 14:36673
Il'in, V.I., Ion source with peripheral magnetic field, 14:37077 (RA;SU;In Russian)
Il'yasov, I.I., Complexing in ternary chloride systems of alkali metals and lead, 14:36792 (RA;SU;In Russian)
Low-melting alloys of halide and nitrate systems of alkali and alkaline earth metals and their practical use, 14:36785 (RA;SU;In Russian)
Study of interaction in ternary bromide systems of lithium, sodium, rubidium, cesium, cadmium, barium, calcium, and lead, 14:36791 (RA;SU;In Russian)
Ilyin, Y.V., *See* Tchurikov, N.A., 14:37307
Inagaki, T., *See* Samuelson, L., 14:36659
Indyk, V.M., DNA biosynthesis content and intensiveness in mice thymus at early periods following fast neutron irradiation with different energy rate, 14:37379 (RA;SU;In Russian)
DNA exchange in mice spleen at early periods following fast neutron irradiation with different energy rate, 14:37378 (RA;SU;In Russian)
Ingersoll, D.T., *See* Rhoades, W.A., 14:37381
Ingold, G., *See* Jahnke, U., 14:37603
Inoko, F., Strain-induced boundary migration (SIBM) in aluminum bicrystals each with a (211) tilt boundary, 14:36525 (BA;FR)
Inoue, Z., Localized electrons in tetragonal $YBa_2Cu_{2.93}O_{6.38}$, 14:36644 (R;CA)
Interrante, G.C., A database for reviews and evaluations of high-level waste documents, 14:35820 (BA;US)
Ioslfescu, M., Minuscule weights and Kronecker products, 14:37701 (RA;RO;In Romanian)
Irie, Haruyuki, *See* Hatori, Tadatsugu, 14:37729
Isaacs, H.S., The influence of surface capacitance on the measurements of localized corrosion transients, 14:36368 (BA;US)
Isaev, N.V., *See* Komarov, V.I., 14:36106
Ishchenko, V.N., *See* Klevtsov, P.V., 14:36758
Ishchenko, Yu.S., Methods of calculation of weldpool surface form on the reverse side of plate under welding by impulse penetrative arc, 14:36560 (RA;SU;In Russian)
Methods of deformation estimation of weldpool surfaces from action of localized pressure under through fusion, 14:36570 (RA;SU;In Russian)
Ishibashi, Y., *See* Akiya, T., 14:36216
Ishida, Y., High resolution electron microscopy of interfaces in functional materials, 14:36623 (BA;FR)
See Hagege, S., 14:36624
Ishikawa, Junzo, Application of ion beams below several hundreds of electron volts. Application to thin film formation, 14:35855 (RA;JP;In Japanese)
Iskander, S.K., An experimental study of the effect of stainless steel cladding on the structural integrity of flawed steel plates in bending, 14:36082 (R;US)
Isocele Collaboration, *See* Weiss, B., 14:37589

ISOCELE Collaboration, *See* Kilcher, P., 14:37594
See Le Blanc, F., 14:37592
Isocelle Collaboration, *See* Bourgeois, C., 14:37627
Isono, H., *See* Otsuki, A., 14:36519
Isono, T., *See* Noji, K., 14:35986
Itoh, Yasuyoshi, *See* Takeuchi, Kiyoshi, 14:36038
Ivakin, A.A., Lithium dodecavanadates with mixed oxidation degree of vanadium, 14:36774 (RA;SU;In Russian)
Ivanenko, V.G., *See* Gorbunov, V.P., 14:37818
Ivanitskaya, I.A., *See* Shevchuk, V.G., 14:36779
See Storozhenko, D.A., 14:36782
Ivannikov, V.I., On the possibility of construction of the parallel-coupled structure for the small-energy electron linear accelerator, 14:37082 (RA;SU;In Russian)
Ivanov, B.I., Application of cyclotron instability for excitation of RF fields in linear accelerators, 14:37059 (RA;SU;In Russian)
Ivanov, L.P., *See* Zajtsev, S.A., 14:36817
Ivanov, Yu.A., *See* Ershov, E.B., 14:37113
Ivanova, N.P., Effect of change in diet on excretion of plutonium-239 from organism, 14:37365 (RA;SU;In Russian)
Ivascu, M., *See* Bucurescu, D., 14:37624
Iverson, L.R., GIS and remote sensing as tools for detection of landscape pattern and processes, 14:35923 (J;US)
See Graham, R.L., 14:37338
Iwamura, Takamichi, Critical heat flux (CHF) characteristics of high conversion pressurized water reactor with double flat core, 14:36010 (R;JP;In Japanese)
Iyi, N., *See* Inoue, Z., 14:36644
Iyyuni, G., *See* Harunuzzaman, M., 14:36432
Izvozchikov, A.B., *See* Askinazi, L.G., 14:37723

J

Jacak, B., Particle production results from HELIOS, 14:37595 (R;US)
Jackson, B.G., *See* Henslee, S.P., 14:35846
Jackson, H., *See* Barnes, P.D., 14:37496
Jackson, P.R., *See* Pinder, J.E. III, 14:35919
Jacob, G., *See* Vigneault, C., 14:36415
Jacobsen, R.T., Study of data distributions and functions for the development of thermodynamic equations of state. Annual report, June 1987-May 1988, 14:35686 (R;US)
Jaervinen, J., Use of the RELVEC code in nuclear power plant operational safety management, 14:35977 (RA;XA)
Jaffa, R., *See* Varsamis, G., 14:37756
Jagannadham, K., *See* Narayan, J., 14:36540
Jahn, H., *See* Bahm, E., 14:37619
Jahn, R.J., *See* King, A.H., 14:36527
Jahn, W., *See* Bongartz, R., 14:36157
Jahnke, U., Multiplicity of neutrons from violent heavy-ion collisions: ^{40}Ar + Th and U from 10 to 77 MeV/u, 14:37603 (R;DE)
Jakob, B., *See* Zichy, J.A., 14:36915
Janakiram, V.K., Randomized parallel branch-and-bound algorithm, 14:37794 (R;US)
Jancaitis, K.S., *See* Murray, J.E., 14:37782
Janke, T.A., *See* Mueller, J.R., 14:36066
Janson, B.N., Estimating departure times from traffic counts using dynamic assignment, 14:36402 (R;US)
Jarrell, D.B., Nuclear plant service water system aging degradation assessment: Phase 1, 14:36166 (R;US)
Jauneau, L., Introduction to gravity and cosmology, 14:37439 (R;FR)
Jeffery, M., *See* Hashemi, S., 14:36007
Jellison, J.L., Mechanisms that control the geometry of pulsed Nd:YAG laser welds, 14:36583 (R;US)
Jenkins, G.R., *See* Theriault, D.J., 14:35701
Jenkins, N.A., *See* Strobel, M.C., 14:37306
Jennings, S.D., Proceedings of the 20th DOE/NRC nuclear air cleaning conference: An index to the 1st–20th AEC/ERDA/DOE and DOE/NRC nuclear air cleaning conferences, 14:37202 (R;US)
Jennison, D.R., *See* Stechel, E.B., 14:37476
Jeong, I.B., Mechanical behaviors of SiC whisker reinforced Al composites by powder metallurgical process, 14:36528 (BA;FR)
Jeong, K.M., *See* Hemsath, K.H., 14:36419
Jernigan, J.G., *See* Kramer, G., 14:37119
Jero, P.D., Investigation of the lanthanide sesquioxides as high temperature transformation toughening agents, 14:36648 (B;US)
Jevicki, A., *See* Feldman, D., 14:37493
Jha, M.C., *See* Boysen, J.E., 14:35513
Jiayu, N., *See* Shubao, X., 14:35599
Jipa, A., *See* Besliu, C., 14:37519
Jiufang Lu, Study of salting effect of D2EHPA in chloride solutions, 14:35765 (RA;SU)
See Yigui Li, 14:36860
Joannopoulos, J.D., *See* Payne, M.C., 14:36487
Jobe, R.K., RF phase distribution systems at the SLC, 14:37094 (R;US)
Johannessen, M., Mitigation studies, 14:37246 (RA;NO)
Johannsen, A., Potential of electric heat pumps for heating water in South Africa, 14:36391 (R;ZA)
Johanson, N.R., *See* Attig, R.C., 14:36349
John, S.F., *See* Skelton, L.W., 14:36433
Johnson, A.B. Jr., *See* Bruemmer, S.M., 14:36601
See Jarrell, D.B., 14:36166
Johnson, C.E., *See* Johnson, I., 14:36185
Johnson, C.R., *See* Cutts, D., 14:37103, 14:37105, 14:37106
Johnson, C.T., *See* Barter, C., 14:37104
Johnson, D.E., *See* Herrup, D.A., 14:36920
Johnson, D.J., *See* Stinnett, R.W., 14:37780
Johnson, G.K., *See* Saboungi, M.L., 14:36662
Johnson, G.L., *See* Clinard, J.A., 14:37819
Johnson, I., Mass spectrometric study of the release of volatile fission products from irradiated LWR fuel, 14:36185 (BA;US)
Johnson, L., *See* Rote, D.M., 14:36401
Johnson, M., *See* Ferrari, M.J., 14:36897
Johnson, M.L., Corporate data base machines: Market analysis for the Joint Staff, 14:37820 (R;US)
Johnson, N.M., *See* Marwick, A.D., 14:36695
Johnson, R., *See* White, B.A., 14:36237
Johnson, R.P., *See* Herrup, D.A., 14:36920
Johnson, V.G., *See* Sommer, D.J., 14:35815
Joksimovich, V., *See* Worledge, D.H., 14:36133
Jones, C.R., *See* Jones, R.H., 14:35767
Jones, E.O., *See* Freeman, H.D., 14:35802
Jones, H.K., Optimization of separation efficiency in capillary zone electrophoresis, 14:36731 (BA;US)
See Smith, R.D., 14:35644
Jones, M.E., *See* Mason, R.J., 14:37806
Jones, R.H., Design considerations for on-site spent-fuel transfer systems: Final report, 14:35767 (R;US)
See Bruemmer, S.M., 14:36601
Jordan, S.E., The assess facility descriptor module, 14:35847 (R;US)
See Paulus, W.K., 14:35848
Joret, H., *See* Della Negra, S., 14:37471
Jorgensen, J.D., *See* Hinks, D.G., 14:36615
Joseph, B.J., *See* Kincy, M.A., 14:36883
Jost, J., Waste heat recovery from a sulfuric acid plant, 14:36414 (R;DE;In German)
Jouan, D., *See* Rivet, M.F., 14:37472
Jouanna, P., *See* Saix, C., 14:36202
Joyce, J., *See* Schiller, D., 14:36359
Joyce, J.A., Development of an engineering definition of the extent of J singularity controlled crack growth, 14:36579 (R;US)
Julin, R., *See* Bucurescu, D., 14:37624
Jung, C., *See* Toge, N., 14:37095
Jung, H.J., Effect of thermal aging on mechanical and electrical properties of the MgO-partially stabilized zirconia bodies, 14:36526 (BA;FR)
Jyothi, A., Studies on extraction of metals with 3-phenyl-4-acyl-5-isoxazolones- new series of chelating extraction, 14:36835 (RA;SU)
Jumlt uttner, A., Base irradiation history and interim inspection of the BWR test fuel rods of rod group BK7: The Studsvik Super-Ramp Project, 14:35997 (R;SE)

K

Kabanov, V.S., *See* Bondarev, B.I., 14:37056

Kachalov, V.V., *See* Spilrain, E.E., 14:35605
Kadomtsev, M.B., *See* Vinitskij, S.I., 14:37705
Kaemaeri, J., Prediction models for acidification, 14:37270 (RA;NO)
Kahana, L., Israel EQAS for thyroid related hormones. Final report for the period June 1984 - February 1988, 14:37316 (R;XA)
Kahn, A.E., Innovative pricing of electricity, 14:36276 (RA;US)
Kahn, E., Validating marginal cost estimates, 14:36287 (RA;US)
Kahn, S., *See* Wanderer, P., 14:36908
Kaiser, G., *See* Johannsen, A., 14:36391
Kaiser, T., *See* Slack, M.W., 14:35627
Kajdanovskij, G.N., Radiometric analysis of probes of environmental objects, 14:37112 (RA;SU;In Russian)
Kalacheva, T.A., *See* Mel'nichenko, E.I., 14:36783
Kalashnikov, A.G., *See* Artem'ev, N.I., 14:36074
Kalia, R.K., *See* Feuston, B.P., 14:37691
Kalinin, G.M., *See* Zajtsev, S.A., 14:36817
Kalinkina, M.B., *See* Vorozhtsov, S.B., 14:37062
Kalinowski, J., *See* Noyes, R.P., 14:37135
Kalinski, R.C., *See* Ehgartner, B.L., 14:35808
Kaloev, N.I., Physicochemical study of the systems BiI_3-M^1I (M^1-Li, Na, K, Rb, Cs) and properties of forming compounds, 14:36796 (RA;SU;In Russian)
See Dzeranova, K.B., 14:36797
See Tsirikhova, N.Kh., 14:36794
Kalonji, G., *See* Counterman, C., 14:36669
Kamenetzky, E.A., The preparation of mechanically alloyed powders for TEM examination, 14:36596 (BA;US)
Kaminskij, A.S., *See* Dirkov, I.V., 14:36108
Kampas, F.J., *See* Delahoy, A.E., 14:35914
Kampwipth, R.T., *See* Baum, H.P., 14:36902
Kampwirth, R.T., *See* Gabutti, A., 14:37123
See Kang, J.H., 14:36950
Kanary, D., *See* Babu, M., 14:35958
Kanciruk, P., *See* Marland, G., 14:37173
Kane, D.J., *See* Eden, J.G., 14:36968
Kang, J.H., Superconducting properties of magnetron sputtered high T_c thin films containing oxide compounds of yttrium, bismuth, or thallium, 14:36950 (J;US)
See Baum, H.P., 14:36902
Kang, Kyungsik, *See* Feldman, D., 14:37493
Kang, M., An improved hibachi support structure for electron-beam diode foils, 14:36963 (R;US)
Kang, S.W., *See* Yu, T.U., 14:35581
Kani, M., *See* Allen, G., 14:36383
Kantele, J., *See* Bucurescu, D., 14:37624
Kapchinskij, I.M. and ot, *See* Artemov, V.S., 14:37036
Kaplin, S.S., *See* Belej, A.S., 14:37037
Karaffa, M.A., Evaluation of asbestos levels in two schools before and after asbestos removal. Final report, 14:37181 (R;US)
Kardivarenko, L.M., *See* Bagreev, V.V., 14:36716
Karlin, N.E., *See* Poplavskij, K.K., 14:37650
Karonis, N., *See* Butler, R., 14:37285
Karpan, N.V., *See* Gorobunov, V.P., 14:36105
Karpov, V.B., Hygienic characteristic of working conditions and use of some evaluation methods of health of persons subjected to concomitant effect of industrial factors, 14:37655 (RA;SU;In Russian)
Karr, T.J., *See* Chambers, D.H., 14:37486
Karril'o Ehredero, Kh.D., *See* Mel'nikov, P.P., 14:36746
Kasatkina, L.A., *See* Mikheeva, T.M., 14:36815
Kash, D.E., *See* Fulkerson, W., 14:36245
Kashiwabara, Hiromichi, *See* Hashino, Tasuke, 14:37731
Kassner, T.F., Effect of temperature and ionic impurities at very low concentrations on stress corrosion cracking of sensitized type 304 stainless steel, 14:36594 (BA;US)
Kasza, K.E., *See* Choi, U.S., 14:36422
See Liu, K.V., 14:36976
Katayama, Y.B., 324 and 325 Building Hot Cell Cleanout Program: Air lock cover block refurbishment, 14:35803 (R;US)
Kato, Takako, *See* Hashino, Tasuke, 14:37731
Katsnel'son, G.M., *See* Poplavskij, K.K., 14:37650
Katti, A.M., Numerical simulation of band profiles for two-component separations by displacement chromatography, 14:36732 (BA;US)
Katz, J.D., *See* Maley, M.P., 14:36945
Katzman, M.T., Insurance and bonding, 14:37401 (R;US)
The value of marginal analysis in electric power system operations, 14:36274 (R;US)
Kauderer, B., Possible roles of tactical nuclear weapons in maritime conflict, 14:36459 (R;US)
Kaufmann, L., *See* Groenemeyer, D.H., 14:37317
Kautz, R.L., Chaos and catastrophe near the plasma frequency in the rf-biased Josephson junction, 14:36906 (J;US)
Kawahata, K., *See* Toi, K., 14:37730
Kawasaki, S., *See* Akiya, T., 14:36216
Kaye, C.J., The effective utilization of differential scanning calorimetry (DSC) to assess molded parts, 14:36678 (R;US)
Kazakov, A., *See* Allen, B.L., 14:36229
Kebadze, B.V., Effect of diffusion on flow-rate time-of-flight measurements, 14:37136 (RA;SU;In Russian)
Keefer, D.G., *See* Horan, J.T., 14:36193
See McIsaac, C.V., 14:36194
Keenleyside, G., Advanced instrument development: a case study. Heavy water monitors: the second generation, 14:36026 (R;CA)
Keierleber, D.P., Electricity - raw material, 14:36317 (RA;US)
Keimirov, M.A., *See* Korpusov, G.V., 14:36843
Keith, D.A.W, Fluvial, estuarine and shallow marine sedimentation in the Lower Cretaceous McMurray Formation and Wabiskaw Member (Clearwater Formation), in the central region, Athabasca oil sands area, northeastern Alberta, 14:35694 (RA;CA)
Keith, D.A.W., *See* MacGillivray, J.R., 14:35699
Kelkar, S., Fracture-height growth containment using low-permeability bridging agents to stimulate tight gas sands with weak barriers. Topical report, January 1982-March 1985, 14:35680 (R;US)
Kelleher, C.M., Offensive versus defensive tradeoffs in the European theater, 14:36456 (R;US)
Keller, D.V. Jr., *See* Good, R.J., 14:35551
Keller, H.M., Event studies and the interpretation of water quality in forested basin, 14:37245 (RA;NO)
Keller, J.F., Regulatory requirements important to Hanford single-shell tank waste management decisions, 14:35801 (R;US)
Keller, R.A., *See* Fairbank, W.M. Jr., 14:37139
Kelley, R.D., *See* Madey, T.E., 14:36742
Kellner, J., Conversion of detached houses with direct electric heating to district heating, 14:36374 (R;SE;In Swedish)
Kelly, E., *See* Wanderer, P., 14:36908
Kelly, J., Abrasive slotting of casing for use in heavy oil well completions and workovers, 14:35619 (RA;CA)
Kelly, T.F., Preparation of thin-foil TEM specimens from submillimeter particulate, 14:36600 (BA;US)
Keltner, N.R., A wind shielded fire test facility, 14:36887 (R;US)
Kemp, W.T., *See* Tallon, R.W., 14:36657
Kempe, A.B., Proposal for the development of a computerized guidance system for the Easi-Miner continuous mining machine, 14:35571 (R;CA)
Kendall, H.W., *See* Womersley, W.J., 14:37122
Kennedy, C., *See* Ruchti, R., 14:37109
Kennedy, C.R., The texture variation in extruded graphite, 14:36663 (R;US)
Kennedy, W.E., Jr., Below regulatory concern owners group: A general review of the IMPACTS-BRC Code: Final Report, 14:35785 (R;US)
Kent, L.A., *See* Keltner, N.R., 14:36887
Kephart, R.D., *See* Fast, R.W., 14:36925
Kerfoot, H.B., Use of industrial-hygiene samplers for soil-gas measurement, 14:37221 (R;US)
Kerivan, D., *See* Babu, M., 14:35958
Kern, E.A., *See* Klosterbuer, S.F., 14:35756
Kerr, N., *See* Scott, J.D., 14:35628
Kerret, H. de, *See* Ait-Boubker, S., 14:37114
Kersteter, S.L., Guidance for the preparation of quality-assurance plans for O_3/CO SIP (State Implementation Plan) emission inventories. Final report, 14:37205 (R;US)
Keskinen, M.J., Stability of laser beams in a structured environment, 14:36975 (BA;US)
Keskinov, V.A., *See* Kopyrin, A.A., 14:36800
Kesmodel, L.L., High resolution electron energy loss studies of surface vibrations: Progress report, July 1, 1988–June 20, 1989, 14:36481 (R;US)

Kettleborough, C.F., *See* Hogan, R.E., 14:37485
Key, B., *See* Jordan, S.E., 14:35847
Khajkina, E.G., Double sodium molybdates with rubidium and cesium, 14:36767 (RA;SU;In Russian)
Khal'baeva, K.M., *See* Khajkina, E.G., 14:36767
Khalfallah, O., Influence of the crystallography on the incorporation of lattice dislocations in grain boundaries, 14:36507 (BA;FR)
Khan, T.A., Data base on dose reduction research projects for nuclear power plants: Volume 3, 14:36160 (R;US)
Occupational dose reduction at nuclear power plants: Annotated bibliography of selected readings in radiation protection and ALARA: Volume 4, 14:36159 (R;US)
Kharlamov, V.V., *See* Chekmarev, A.M., 14:36824
Kharlamova, I.M., *See* Chekmarev, A.M., 14:36824
Khas'yanova, G.L., *See* Ishchenko, Yu.S., 14:36570
Khazheeva, Z.I., *See* Mokhosoev, M.V., 14:36766
Khitrov, V.A., *See* Boneva, S.T., 14:37633
Khizhnyak, N.A., *See* Belikov, V.V., 14:37078
See Borovskij, I.V., 14:37061
Khodakov, V.A., Some problems on an absorber burnup in an infinite half-space, 14:36019 (RA;SU;In Russian)
Kholmurodov, Kh.T., *See* Barashenkov, I.V., 14:37703
Kholodkovskaya, L.N., *See* Borodina, L.A., 14:36750
Khromov, A.A., *See* Il'in, V.I., 14:37077
Khutsistova, F.M., *See* Tsirikhova, N.Kh., 14:36794
Kibler, M., Periodic system of chemical elements: old and new developments, 14:36703 (R;FR)
Kidwell, M.G., Regulatory aspects of the expression of P-M hybrid dysgenesis in Drosophila, 14:37294 (RA;US)
Kiehn, G.P., XUV laser amplification in recombining laser-produced plasmas, 14:37489 (D;GB)
Kifune, K., *See* Kitano, Y., 14:36491, 14:36543
Kilcher, P., Decay of doubly-odd nucleus ^{184}Ir, 14:37594 (R;FR)
See Bourgeois, C., 14:37627
See Le Blanc, F., 14:37592
Kilkenny, J. D., *See* Balmer, J., 14:37752
Killeen, T., *See* Lorenz, R., 14:37255
Killinger, M.H., Hanford Site implementation of the National Environmental Policy Act: Activities tracking, 14:37276 (R;US)
Kim, G.M., Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1, 14:35538 (R;US)
Kim, Y.C., *See* Christen, D.K., 14:36952
See Sekula, S.T., 14:36949
Kimura, A., *See* Birnbaum, H.K., 14:36501
Kimura, Itsuro, Techniques for utilization of nuclear reactor neutrons for semiconductor research. Current situation and problems to be solved in future, 14:36724 (RA;JP;In Japanese)
Kincy, M.A., TRUPACT I filter development: Status report, 14:36883 (R;US)
King, A.H., Dependence of diffusion-induced grain boundary migration on grain boundary structure, 14:36527 (BA;FR)
Grain boundary structure in HCP metals, 14:36490 (BA;FR)
King, C.J., *See* Arenson, D.R., 14:36725
King, W.E., Effect of Y_2O_3 additions on the plasticity of sintered Cr_2O_3, 14:36607 (J;US)
Kingsley, I., Health-hazard evaluation determination report No. 75-178-295, New York Telephone and Telegraph Company, 770 Broadway, New York, New York, 14:37183 (R;US)
Kinney, E.R., *See* Young, L., 14:37572
Kinnison, D.E., Effects of trace gases on global atmospheric chemical and physical processes, 14:37195 (R;US)
Kinoshita, K., Fuel cell technology in the United States, 14:36362 (R;US)
Kirkbride, R.A., Evaluation of minimum-fluidizing velocity correlations for bed particles used in fluidized-bed calcination processes, 14:35816 (R;US)
Kirkland, O.L., *See* Toth, L.M., 14:36856
Kirsch, L.D., Customer outage costs: their role in system planning and pricing, 14:36280 (RA;US)
Kirsch, L.E., Research in elementary particle physics: Technical progress report, June 1, 1988–May 31, 1989, 14:37494 (R;US)
Kirshner, R., *See* Sanz Fernandez de Cordoba, L., 14:37429
Kirwan, D.J., *See* Scott, C.D., 14:35905
Kisel', N.N., *See* Shevchuk, V.G., 14:36781
Kisel'gof, E.B., Peculiarities of cytogenetic efficiency of irradiation of patients in case of various types of mammography, 14:37657 (RA;SU;In Russian)
Kiselev, A.E., *See* Gamalij, E.G., 14:37727
Kiselev, G.V., *See* Zaritskaya, T.S., 14:36127
Kiselev, I.V., *See* Amosov, I.I., 14:37081
Kispert, L.D., Catalyst accessibility in high voltatile bituminous coal: Quarterly report, 14:35555 (R;US)
Kistiakowsky, V., *See* Womersley, W.J., 14:37122
Kitano, Y., Extended CSL-model for grain boundary in layer structures, 14:37667 (BA;FR)
Star-disclination in a ferro-elastic material B19 MgCd alloy, 14:36543 (BA;FR)
Star-lisclination in a ferro-elastic material B19 MgCd alloy, 14:36491 (BA;FR)
Kiyashko, V.A., Numerical simulation of plasma-filled diode gap with magnetic insulation, 14:37057 (RA;SU;In Russian)
Klaening, U.K., Protolytic properties of perxenic acid, 14:36853 (J;US)
Klatt, L.N., [Analytical chemistry in nuclear technology, Karlsruhe, Germany and visit to Seibersdorf, Austria, June 3–22, 1989]: Foreign trip report, 14:35766 (R;US)
Klebanov, I., Wormholes and the cosmological constant, 14:37711 (J;NL)
Kleckner, N., *See* Roberts, D., 14:37304
Klein, B., *See* Sice, H., 14:35637
Kleindorfer, P.R., Demand charge: does it fit in?, 14:36296 (RA;US)
Kleiner, R.N., *See* Coubrough, L.E., 14:35688
Klepatskij, A.B., Estimations and theoretical forecasting of ^{236}U neutron data in the energy range of neutrons up to 20 MeV, 14:37625 (RA;SU;In Russian)
Klevtsov, P.V., Synthesis and phase transformations of double chromates of cesium rubidium and potassium with lithium, M^+LiCrO_4, 14:36758 (RA;SU;In Russian)
Klevtsova, R.F., *See* Klevtsov, P.V., 14:36758
Kliman, J., *See* Bogdzel', A.A., 14:37604
See Gundorin, N.A., 14:37634
Kliman, M.L., *See* Allen, B.L., 14:36229
Klinzing, G.E., Studies of dense phase cohesive coal transport in plugs: Quarterly report, April–June 1989, 14:35578 (R;US)
Kloeti, P., *See* Keller, H.M., 14:37245
Klokk, T., *See* Sveum, P., 14:35662
Klomfass, J., *See* Roedig, M., 14:36571
Klosterbuer, S.F., Unattended mode operation of specialized NDA [nondestructive assay] systems, 14:35756 (R;US)
Kluge, G., Structural-engineering studies on the use of filter dusts from waste-incinerator flue gas cleaning as an aggregate bitumen in road construction, 14:36420 (R;DE;In German)
Knapp, F.F. Jr., Nuclear Medicine Program progress report for quarter ending December 31, 1988, 14:37320 (R;US)
Knazovich, M., Crisis management program for senior officials, 14:35830 (RA;US)
Knickerbocker, K., *See* Ruchti, R., 14:37109
Knight, A.W., *See* Adelman, K.L., 14:36458
Knipping, U., *See* Wilson, I.H., 14:36656
Knop, R., *See* Pouliot, J., 14:37599
Knox, J.B., Backgrounder contribution No. 18: Climate scenarios for the first UC/DOE workshop, 14:37161 (R;US)
Knox, J.M., *See* Walsh, D.S., 14:37777
Knutson, B.J., Fast Flux Test Facility passive safety reactivity feedback measurements, 14:36034 (R;US)
Knystautas, R., *See* Guirao, C.M., 14:36161
Koanigawa, T., *See* Parkosh, S., 14:36734
Kobayashi, A., *See* Noji, K., 14:35986
Kobayashi, M., *See* Inoko, F., 14:36525
Koch, P., $K^{\pm}$, p^-, and Ω^- production in relativistic heavy ion collisions, 14:37638 (J;US)
Kocher, D.C., An update on standards for radiation in the environment and associated estimates of risk, 14:37345 (R;US)
Kocks, U.F., *See* Rollett, A.D., 14:36572
Koda, T., *See* Suganami, T., 14:36390
Kodama, H., *See* Kotlyar, L.S., 14:35733

Koelling, D.D., What underlies the Anderson Hamiltonian?, 14:37696 (BA;US)
Kogut, A.J., Spectral measurements of the cosmic microwave background, 14:37441 (R;US)
Kohlmeyer, B., *See* Heusch, B., 14:37587
Koide, Yoshihiko, *See* Nishino, Nobuhiro, 14:37733
Kojima, Tsuyoshi, *See* Matsuura, Kiyokata, 14:37804
Kokorev, L.S., *See* Bol'shakov, V.I., 14:36017
Kolarik, Z., Separation potential of solvent extraction in the recovery of metals, 14:35762 (BA;US)
Kolasa, J., Determinants of Daphnia clonal diversity in lakes, 14:37277 (J;US)
Kolb, E.W., *See* Copeland, E., 14:37541
Kolomiets, A.A., *See* Andreev, V.A., 14:37083
See Il'in, V.I., 14:37077
Kolossa, E., Development of radioimmunological methods to determine the constituents of nicotiana plants and cell cultures, 14:37299 (R;DE;In German)
Komarov, V.I., Experience in using the in-situ subsystem providing reactor operation in on-line control system of the Smolensk NPP, 14:36106 (RA;SU;In Russian)
Komatsu, S.-E., *See* Takatsuka, T., 14:35635
Komissarov, Yu.O., *See* Kebadze, B.V., 14:37136
Komissarova, L.N., Synthesis and structure of mixed by cation ternary vanadates $Me_2MeLn(VO_4)_2$, 14:36745 (RA;SU;In Russian)
See Mel'nikov, P.P., 14:36746
Komori, Junko, Analysis of impurities in semiconductor by IMA (SIMS), 14:36723 (RA;JP;In Japanese)
Komshilova, O.N., *See* Volkov, A.I., 14:36757
Komura, Y., *See* Kitano, Y., 14:36491, 14:36543, 14:37667
Kondo, Yasuhiko, *See* Muramatsu, Ken, 14:35993
Kondratov, O.I., *See* Poloznikova, M.Eh., 14:36763
Konyukhov, V.V., *See* Voropaev, S.G., 14:37721
Kool, J.B., *See* Huyakorn, P.S., 14:35793
Koontz, S.L., *See* Cross, J.B., 14:36844
Koos, D.A., *See* Richmond, G.L., 14:36369
Kopacz, S., Mechanism of extraction 4th period of periodic system metal ions with carboxylic acids in sulphate systems, 14:36828 (RA;SU)
Koploy, M., *See* Shatoff, H., 14:36871
Kopylov, V.I., *See* Sinitsyn, O.A., 14:36876
Kopyrin, A.A., Solubility of sulfates and oxalates of alkaline earth metals in aqueous solutions of alkali metal salts, 14:36800 (RA;SU;In Russian)
See Sedov, V.M., 14:36717
Korabel'nikova, L.M., Effect of carrier nature and Pt concentration on catalytic properties of deposited catalysts with respect to reaction of homomolecular isotopic exchange of hydrogen, 14:36812 (RA;SU;In Russian)
Korelina, N.F., Review of investigations concerning radioactive aerosol deposition in lungs of man, 14:37649 (RA;SU;In Russian)
Korn, D., Measurements of the elastic constants, the specific heat and the entropy of grain boundaries by means of ultra-fine grained materials, 14:36541 (BA;FR)
Kornienko, Yu.N., *See* Selivanov, V.M., 14:36071
Kornilov, E.A., *See* Kiyashko, V.A., 14:37057
Koroleva, N.A., *See* Terent'ev, M.V., 14:37659
Koroleva, T.M., *See* Poplavskij, K.K., 14:37650
Korovin, V.Yu., *See* Varnek, A.A., 14:36818
Korpusov, G.V., Complexones in the processes of extraction of rare earth elements, 14:36820 (RA;SU)
Some regularities of extraction of rare earth elements by organophosphoric acid, 14:36843 (RA;SU)
See Danilov, N.A., 14:36842
Korshunov, I.A., *See* Egorov, N.P., 14:36795
Korsun, V.P., Phase equilibria in the systems Li_2MoO_4-$BaMoO_4$-$Ln_2(MoO_4)_3$, Ln=La-Lu, Y. Luminescence of $Li_3Ba_2Ln_3(MoO_4)_8$-Nd^{3+}, 14:36760 (RA;SU;In Russian)
Kortright, J.B., Electrochemically adsorbed Pb on Ag (111) studied with grazing- incidence x-ray scattering, 14:36854 (R;US)
Koryakova, O.V., *See* Ivakin, A.A., 14:36774
Kosek, F., Ninth conference of Czechoslovak physicists. Part 1, 2, 14:37678 (R;CS;In Czech, Slovak)
Koska, W., *See* Bowden, G., 14:37126
Kosobokova, N.S., *See* Mardirosova, I.V., 14:36747
Kot, C.A., *See* Hsieh, B.J., 14:36085, 14:36143
Kotanigawa, T., *See* Parkash, S., 14:36733
Kotlyar, L.S., Comparative study of organic rich solids present in Utah and Athabasca oil sands, 14:35733 (RA;CA)
Kovach, S.K., *See* Semrad, E.E., 14:36772
Kovalenko, V.I., *See* Alekseeva, V.A., 14:37653
Kovalev, A.E., Sulfates of rare alkali metals, 14:36799 (RA;SU;In Russian)
Kovalsky, J.A., *See* Haston, J.A., 14:35721
Kovtun, V.E., *See* Getmanov, B.S., 14:37552
Kowalczyk, R.S., *See* Young, L., 14:37572
Kowaleski, R., Radiology PRICER 2.0 subroutines for RADMAIN and RADPRICE. Software, 14:37321 (R;US)
Radiology PRICER 2.0 subroutine installation guide, Volume 1 and Volume 2, 14:37322 (R;US)
Koyama, Hiroshi, *See* Komori, Junko, 14:36723
Kozak, V.R., Driver and controller for the Odrenok computer, 14:37085 (R;SU;In Russian)
Kozhevnikova, N.M., *See* Korsun, V.P., 14:36760
Kozin, I.O., Method for calculating optimal rules of making the decisions about accidents in commercial equipment, 14:36107 (RA;SU;In Russian)
Kozlova, N.S., *See* Zakharov, N.A., 14:36809
Kozlovskij, V.I., *See* Akhekyan, A.M., 14:37681
Kozodaev, A.M., Stabilization of charging voltage in high-voltage linear modulator with optron control circuit, 14:37084 (RA;SU;In Russian)
See Andreev, V.A., 14:37083
Kozuka, Toshihiko, Report on the instrumented Charpy impact test for metallic materials, 14:36992 (R;JP;In Japanese)
Kozyukova, N.V., *See* Semenov, G.A., 14:36771
Kraft, G., *See* Toburen, L.H., 14:37663
Krahenbuhl, L., *See* Hodgdon, M.L., 14:37480
Krahn, L., *See* TenWolde, A., 14:36378
Kramer, G., Silicon PIN diode hybrid arrays for charged particle detection: Building blocks for vertex detectors at the SSC, 14:37119 (R;US)
Kramlich, J.C., *See* Muzio, L.J., 14:37197
Krantz, G.W., Role of environmental qualification training in nuclear plant maintenance, 14:36140 (RA;US)
Krantz, M., Forecasting day-ahead marginal costs, 14:36286 (RA;US)
Krasilov, Yu.I., *See* Masloboev, V.A., 14:36751
Kraske, F., *See* Toburen, L.H., 14:37663
Krasnov, S.A., Study on total disintegration of lead nuclei with magnesium-24 nuclei at 4.5 A GeV/c, 14:37598 (R;SU;In Russian)
Krasznai, J.P., *See* Krochmalnek, L.S., 14:35770
Kraus, W., *See* Baumann, H., 14:37384
Krause, F., *See* Goldman, C., 14:36338
Kravchuk, K.G., *See* Azarova, L.A., 14:36793
Krebs, H.J., *See* Fast, R.W., 14:36925
Kreilick, T.S., *See* Gregory, E., 14:36938
Kresin, V.Z., Properties of the new high T_c materials, 14:36654 (J;US)
Kress, T.S., Correlation of recent fission product release data, 14:36110 (R;US)
Krider, J., Residual gas beam profile monitor, 14:37125 (J;NL)
Krishnan, K.M., Channelling and related effects in electron microscopy: The current status, 14:36726 (R;US)
Krishnan, R.P., *See* Bradshaw, W.M., 14:36416
Kristallov, L.V., Vibrational spectra and structure of vanadates $M_2Zn(VO_3)_4$, where M-Rb, Cs, 14:36775 (RA;SU;In Russian)
Kristiak, J., *See* Bogdzel', A.A., 14:37604
See Gundorin, N.A., 14:37634
Krisyuk, Eh.M., Doses from natural sources of ionizing radiations and feasibilities of their restriction, 14:37658 (RA;SU;In Russian)
Krivko, I.P., *See* Banik, V.V., 14:36804
Krivulya, S.Yu., *See* Belej, A.S., 14:37037
Krochmalnek, L.S., Conditioning and handling of tritiated wastes at Canadian nuclear power facilities, 14:35770 (R;CA)
Krois, P.A., *See* Carter, R.J., 14:36046
Kromp, K., *See* Mueller, M., 14:36986

Kronfeld, J., $^{230}Th/^{234}U$ dating of the quaternary spring travertines in the Arava Rift Valley of Israel and paleoclimatic implications. Final report for the period 15 December 1986 - 15 December 1987, 14:37405 (R;XA)
Kropp, J., *See* Knapp, F.F. Jr., 14:37320
Kruchinina, M.V., *See* Ivakin, A.A., 14:36774
Kruger, C.H., *See* Akan-Etuk, Nniefiok, 14:35583
Krumhansl, J.L., Waste Isolation Pilot Plant brine field pH measurements: Technique and interpretation, 14:35810 (R;US)
Kruse, H.W., *See* Cochrane, J.C., 14:37686
Krutyakov, A.N., Investigations into physicochemical properties of lithium metaaluminate ceramics, 14:36636 (RA;SU;In Russian)
Synthesis and properties of $LiAlO_2$ lithium aluminate monocrystals, 14:36637 (RA;SU;In Russian)
Krylov, Yu.S., *See* Korpusov, G.V., 14:36820
Ku, L.P., *See* Liew, S.L., 14:37772
Kubenka, J.H., Systematic problem solving process (SPSP) - root cause analysis that works, 14:36137 (RA;US)
Kubo, Hirotaka, *See* Nishino, Nobuhiro, 14:37733
Kubo, Reijiro, Relations between Virasoro algebra and Krichever-Novikov algebra on a torus, 14:37556 (R;JP)
Kubursi, A.A., *See* Allen, B.L., 14:36229
Kucera, V., Effect of acidification on structures in soil and water, 14:37268 (RA;NO)
Kucheryaev, Yu.A., *See* Zhil'tsov, V.A., 14:37765
Kuchnir, M., Flux creep in a Tevatron cable, 14:36932 (J;US)
See Herrup, D.A., 14:36920
See Strait, J., 14:36912
Kudritskij, Yu.K., Hygienic significance of radiostability as measures of adaptive feasibilities, 14:37651 (RA;SU;In Russian)
Kudrova, L.G., *See* Bol'shakov, V.I., 14:36017
Kuemanguzhina, L.K., *See* Fakeev, A.A., 14:36811
Kuff, E.L., Factors affecting retrotransposition of intracisternal A-particle proviral elements, 14:37289 (RA;US)
Kulak, R.F., A method for three-dimensional structural analysis of reinforced concrete containment, 14:36142 (R;US)
Kulawik, I., Hydration and solvation energies and thermodynamic distribution coefficient of some extraction systems, 14:36825 (RA;SU)
Kulawik, J., *See* Kulawik, I., 14:36825
Kuligina, T.V., *See* Slivko, T.A., 14:36789
Kulikov, M.V., Program for calculating parameters of atomic beam of polarized particle source and jet polarized targets on 'Pravets-16', 14:37086 (R;SU;In Russian)
Kulikova, S.B., Interconnection of individual peculiarities of blood system with radiation syndrome severity in animals, 14:37357 (RA;SU;In Russian)
Kumbartzki, G., *See* Benczer-Koller, N., 14:37590
Kumpulainen, J., *See* Bucurescu, D., 14:37624
Kuntosch, G., *See* Aurich, J., 14:36832
Kuranov, K.E., Lithium beryllates and their thermodynamic properties, 14:36790 (RA;SU;In Russian)
Kurbatov, V.A., *See* Aslanov, G.A., 14:37726
Kurgan, G.J., Cost impact of potential RCRA (Resource Conservation Recovery Act) changes on New York State Utility coal-waste disposal. Final report, 14:35563 (R;US)
Kurilenko, L.I., Physicochemical features of Li_2MoO_4 and Li_2WO_4 behaviour under different methods of treatment, 14:36769 (RA;SU;In Russian)
Kurilko, V.I., Physical experiment technique. Scientific-technical collection, 14:37419 (R;SU;In Russian)
Kurochka, V.E., *See* Banik, V.V., 14:36808
Kurt, V.G., *See* Giovannelli, F., 14:37434
Kutter, B.L., Centrifuge tests on simulation of the "cookie cutter" mechanism of chimney collapse into underground openings: Final report, 14:37159 (R;US)
Kutzak, A.R., Mobil Oil Canada's use of insulated tubulars in thermal projects, 14:35724 (RA;CA)
Kuz'michev, V.G., *See* Kozodaev, A.M., 14:37084
Kuznetsov, A.A., *See* Baldin, A.M., 14:37632
Kuznetsov, A.N., *See* Varnek, A.A., 14:36818
Kuznetsova, Yu.S., *See* Ryabenko, E.A., 14:36805
Kwak, J.F., *See* Venturini, E.L., 14:36584, 14:36647
Kwasnitza, K., *See* Zichy, J.A., 14:36915
Kwei, G.H., *See* Ott, K.C., 14:36639
Kyrs, A.R., *See* Kozodaev, A.M., 14:37084

L

Laabs, F.C., *See* Trybus, C.L., 14:36599
Labarga, L., *See* Adolphsen, C., 14:37096
LaBelle, R.D., *See* Fairbank, W.M. Jr., 14:37139
Labuschagne, B.C.J., Oil phase in selective agglomeration: a structural approach, 14:35515 (R;ZA)
Ladd, A.J.C., Dynamics of colloidal dispersions via lattice-gas models of an incompressible fluid, 14:37488 (R;US)
Laderman, S.S., *See* Missert, N., 14:36955
Ladna, B., Unusual segregation behavior of boron and its effect on segregation of sulfur in nickel, 14:36508 (BA;FR)
See Birnbaum, H.K., 14:36501
Ladouceur, M, Plasma spraying of WO/sub3/. Structure characterization of the coating, 14:36643 (R;CA)
LaFond, J.F., Development of a vortex-containment combustor for coal-combustion systems. Report for January 1980-December 1983 (Final), 14:35591 (R;US)
Lagerbaeck, R., Postglacial faulting and paleoseismicity in the Landsjaerv area, northern Sweden, 14:37414 (R;SE)
Lagutenkov, V.A., *See* Skorovarov, D.I., 14:36864
Lai, S.T., An overview of atomic and molecular processes in critical velocity ionization, 14:37750 (J;US)
Lai, Z.H., Enhanced concentrations of Ni at grain boundary dislocations in Ni-treated W, 14:36511 (BA;FR)
Laing, J.M., Geotechnical instrument tation of the AOSTRA mine-assisted underground steaming trial, 14:35720 (RA;CA)
LaJeunesse, C.A., Development of a thin wall graphite/polyimide composite pressure vessel with a large aspect ratio, 14:36884 (R;US)
Lalungpa, S.D., Transferring technology. A social marketing perspective, 14:36230 (RA;CA)
Lamb, D.Q., *See* Shrader, C.R., 14:37433
Lambert, M.E., Inducible cellular responses to DNA damage, 14:37387 (RA;US)
Lamm, M., *See* Strait, J., 14:36912
Lamm, M.J., *See* Hanft, R.W., 14:36921
See Herrup, D.A., 14:36920
Lampa, J., *See* Portfors, E., 14:35870
Lampe, R.L., *See* Parr, B.F., 14:37189
Lamport, D.T.A., *See* Rorrer, G.L., 14:35869
Lamppa, K.P., *See* Dreike, P.L., 14:37775
Lanagan, M.T., *See* Bohn, C.L., 14:36954
Lancaster, D.E., *See* Murtha, J.A., 14:35676
Lancin, M., Phase transformation in boron doped SiC: HREM study of a twin interface, 14:36630 (BA;FR)
Landers, D.H., *See* Brakke, D.F., 14:37267
Lane, H.S., *See* Murtha, J.A., 14:35676
Lane, K., Two-scale technicolor, 14:37539 (J;NL)
Langan, S.J., Use of representative field plots for the determination of hydrological flow-paths and associated hydrochemistry in studies of surface water acidification, 14:37261 (RA;NO)
Langdon, T.G., *See* Raman, V., 14:36988
Langevin-Joliot, H., High lying and high spin states in heavy nuclei via transfer reactions, 14:37629 (R;FR)
Selective population of the highest spin n-p states in heavy nuclei via the (α, d) reaction at 218 MeV, 14:37588 (R;FR)
Langhame, Y., Effect of oil viscosity on transformer loading capability at ambient temperatures below 0^0C, 14:35972 (R;CA)
Langley, R.A., A technique for efficiently cleaning and conditioning low- and medium-energy accelerators, 14:37045 (R;US)
Recent results on cleaning and conditioning the ATF vacuum system, 14:37758 (R;US)
Langston, M.E., *See* Houlberg, L.M., 14:37220
Langton, C.A., Solidification of low-level radioactive waste at the Savannah River Site, 14:35818 (R;US)
Lanier, R.G., *See* Fields, D.J., 14:37600
Lanou, R.E. Jr., Progress report of a research program in experimental high energy physics, January 1, 1989–December 31, 1989, 14:37500 (R;US)

Lapostolle, P.M., Proton linear accelerators: A theoretical and historical introduction, 14:37040 (R;US)
Lappin, A.R., Systems analysis, long-term radionuclide transport, and dose assessments, Waste Isolation Pilot Plant (WIPP), southeastern New Mexico; March 1989, 14:35811 (R;US)
Lappin-Scott, H., *See* Singh, S., 14:35707
Larbalestier, D.C., *See* Hampshire, D.P., 14:36951
Larere, A., Segregation energies of phosphorus and sulfur in various relaxed structures of grain boundaries in Ni by tight-binding approximation, 14:36509 (BA;FR)
Larker, R., Diffusion reactions between silicon oxynitride and silicon nitride during HIP-synthesis, 14:36625 (BA;FR)
Larkin, T.H., *See* Briles, S.D., 14:37137
Larson, E.M., *See* Greeger, R.B., 14:36649
Larson, E.T., *See* Niemann, R.C., 14:36922
Larsson, G., Discussion on planning and pricing, 14:36337 (RA;US)
Larsson, M., *See* Brunstroem, C., 14:35935
Lartigue, S., Influence of doping elements on the grain boundary characteristics in alumina, 14:36632 (BA;FR)
Lasarenko, B.A., *See* Young, L., 14:37572
Laskorin, B.N., Application of eda interactions for explaining and forecasting the extractive ability of elementoorganic reagents, 14:36858 (RA;SU)
Lassiter, S., *See* Harwood, L.H., 14:36939
Laszlo, R., *See* Spilrain, E.E., 14:35605
Latham, P.E., *See* Booske, J.H., 14:36961
Lau, C.M., *See* Pavlopoulos, T.G., 14:36958
Lau, Chun Wei, An engineering model for coal devolatilization: Quarterly report, December 15, 1988–March 15, 1989, 14:35584 (R;US)
Lau, H., *See* Ayres, J.M., 14:36413
Laughlin, A.W., *See* Van Eeckhout, E., 14:36236
Laughlin, D.L., Bulk Shielding Facility quarterly report, January, February, and March 1989, 14:36125 (R;US)
Laurent-Pinson, E., *See* Vicens, J., 14:36628
Laval, J.Y., Structure and local electrical properties of grain boundaries in polycrystalline semiconductors, 14:36672 (BA;FR)
See Thorel, A., 14:36671
Lavender, D.R., *See* Stone, S.K., 14:36057
Lavrent'ev, O.A., *See* Vdovin, S.A., 14:37722
Law, A.G., *See* Sommer, D.J., 14:35815
Law, R.J., *See* Ruiz, C.P., 14:35991
Lawless, J.L., *See* Stefani, F., 14:37751
Lawson, R.D., *See* Smith, A.B., 14:37613, 14:37614
Lazareth, O., *See* Ludewig, H., 14:36128
Lazorenko, N.M., *See* Shevchuk, V.G., 14:36781
Lazoryak, V.I., Ternary phosphates $Ca_8LiR_2(PO_4)_7$ (R=rare earths, Y, Bi), 14:36756 (RA;SU;In Russian)
Le Beyec, Y., *See* Della Negra, S., 14:37471
Le Blanc, F., Shape transition in neutron deficient PT isotopes, 14:37592 (R;FR)
Le Gac, J., *See* Bernhard, S., 14:35834
Lebedev, O.V., *See* Alekseeva, V.A., 14:37653
Lebedev, S.V., *See* Askinazi, L.G., 14:37723
See Voropaev, S.G., 14:37721
LeBlanc, B., Alternative rate design in the United States, 14:36332 (RA;US)
LeBlanc, W., Pricing electric power and services in a dynamic marketplace, 14:36275 (RA;US)
Pricing innovation and latent technology development: the chicken and egg syndrome, 14:36304 (RA;US)
Lederer, C.C., Computer-assisted control for municipal water systems: Phase II, Implementation of a computer-assisted energy management program, 14:36254 (R;US)
Computer-assisted control for municipal water systems: Phase 1, Design for energy cost savings, 14:36427 (R;US)
Lee, A.S., Upgrading of heavy crude at low-temperature and ambient-atmosphere, 14:35638 (RA;CA)
Lee, D.N., *See* Jeong, I.B., 14:36528
Lee, H.I., *See* Jeong, I.B., 14:36528
Lee, H.L., *See* Jung, H.J., 14:36526
Lee, J.C., *See* Wehe, D.K., 14:37816
Lee, J.H., *See* Guirao, C.M., 14:36161
Lee, J.J., *See* Crawford, L.W., 14:36358
Lee, J.K.P., *See* Bourgeois, C., 14:37627
See Kilcher, P., 14:37594
See Le Blanc, F., 14:37592
Lee, K., *See* Babu, M., 14:35958
See Copeland, E., 14:37541
Lee, M.H., Electron beam propagation in inhomogeneous media, 14:37747 (BA;US)
Lee, R. W., *See* Balmer, J., 14:37752
Lee, S.J., *See* Persad, C., 14:36611
Lee, S.Y., [Environmental assessment for radioactive waste disposal, Daeduk, South Korea, May 12–June 14, 1989]: Foreign trip report, 14:35797 (R;US)
See Chin, D.K., 14:36899
Lee, T.C., *See* Robertson, I.M., 14:36533
Lee, Y.C., *See* Keskinen, M.J., 14:36975
Lee, Y.M., *See* Glovan, R.J., 14:36356
Leeper, R.J., *See* Stinnett, R.W., 14:37780
Lees, M.G., Design guidelines for a furnace sorbent injection waste management system: Final report, 14:35959 (R;US)
Lefievre, B., *See* Ait-Boubker, S., 14:37114
Leib, T.K., *See* Holmes, D.S., 14:37324
Leigh, C.D., A sensitivity of aerosol agglomeration and deposition using the MAEROS model, 14:36188 (BA;US)
Leigh, J.R., *See* Hinde, D.J., 14:37607
Leight, J.R., *See* Newton, J.O., 14:37606
Leishman, N.L., Management Information Database System, 14:37822 (R;US)
Lejcek, P., Migration of differently oriented grain boundaries measured on Fe-3wt%Si 37° (001) bicrystals, 14:36522 (BA;FR)
Lemieux, M., *See* Vigneault, C., 14:36205
Lemos, B.J.K.C., *See* Nair, R.P.K., 14:37801
Lenner, G., *See* Benczer-Koller, N., 14:37590
Lenoir, Y., OPENSOL. Software for the optimization of sizing and control of complex heating systems with long-term heat storage, 14:36381 (RA;CA;In French)
Lenz, T.G., Study of improved methods for predicting chemical equilibria: Composite technical progress report, July 1, 1986–June 30, 1989, 14:36739 (R;US)
Leonard, R.A., Recent advances in centrifugal contactor design, 14:35822 (J;US)
Leonchuk, M.P., *See* Selivanov, V.M., 14:36071
Leoni, R., *See* Rosenthal, P., 14:36900
Leont'ev, V.N., *See* Amosov, I.I., 14:37081
Lepeshkov, I.N., *See* Il'yasov, I.I., 14:36791
Lequien, S., Dynamical properties in metallic reentrant in spin glasses studied by inelastic neutron scattering, 14:36546 (R;FR;In French)
Lerch, P., *See* Rosenthal, P., 14:36900
Lerchl, G., *See* Beraha, D., 14:36153
See Teschendorff, V., 14:36152
LeRose, J., *See* Brindza, P., 14:36934
Leroy, G., Transient response of an in-ground vertical cylindrical heat exchanger. Thermal characterization of the soil, 14:36199 (RA;CA;In French)
Leroy, M.J.F., *See* Sastre, A., 14:36833
Leshchyshyn, T., In situ oil sands temperature logging, 14:35725 (RA;CA)
Lestz, S.J., *See* Likos, W.E., 14:35666
Lett, R.G., *See* Cugini, A.V., 14:35546
Levine, M.D., Energy use in buildings: The US experience and lessons for China, 14:36384 (R;US)
Levush, B., *See* Booske, J.H., 14:36961
Levy, A., *See* Chace, A.S., 14:36412
Levy, A.V., Proceedings of the 3rd Berkeley conference on corrosion-erosion-wear of materials at elevated temperatures, 14:36589 (B;US)
Levy, B.S.B., Health-hazard evaluation determination report No. 75-151-259, Winchester Hospital, Winchester, Massachusetts, 14:37184 (R;US)
Levy, M., *See* Baum, H.P., 14:36902
Lewis, B.E., *See* Carnal, C.L., 14:35763
Lewis, C. L. S., *See* Balmer, J., 14:37752
Lewis, R.E., The hydrothermal system in central Twin Falls County, Idaho, 14:35938 (R;US)

Lewis, S.N., *See* Davison, B.H., 14:35519
Lewis, S.R., *See* Benjamin, A.S., 14:36177
Li Panyu, Investigation of hydrofluorination reactivity on denitrated uranium oxides, 14:35753 (R;CN;In Chinese)
Li, M.F., Lattice relaxation of the DX centers in $Ga_{1-x}Al_xAs$ and of the pressure-induced deep donors in GaAs, 14:36699 (BA;US)
Li, Mingyang, Comparison of analytical and computational estimates of reduction in linear aperture in the presence of sextupole field, 14:37047 (R;US)
Liang Yutang, *See* Zhao Yunlong, 14:36705
Liang, C.F., *See* Weiss, B., 14:37589
Libera, M.R., *See* Kelly, T.F., 14:36600
Liberman, A.N., Radiation hygienic characteristic of working conditions and health of women operating in X-ray diagnostic departments, 14:37654 (RA;SU;In Russian)
Liberman, S., *See* Le Blanc, F., 14:37592
Lichtenwalner, D.J., Effect of noble gases on the properties of ion-beam-sputtered niobium films, 14:36465 (R;US)
Lieberman, M.A., Dynamics of a collisional, capacitive RF sheath, 14:37753 (J;US)
Liew, S.L., Formulation and solution of the delayed gamma dose rate problem using the concept of effective delayed gamma production cross section, 14:37772 (R;US)
Lifshits, M.L., Introduction of experience of television information-control systems in welding, 14:36569 (RA;SU;In Russian)
Lightbody, J., *See* Gross, F., 14:37566
Liimatainen, V.A., *See* Wales, D.L., 14:37392
Likos, W.E., Laboratory evaluation of MIL-T-83133 JP-8 fuel in army diesel engines. Interim report, October 1984-January 1988, 14:35666 (R;US)
Lillie, R.A., Sensitivity/uncertainty analysis for free-in-air tissue kerma due to initial radiation at Hiroshima and Nagasaki, 14:36196 (J;US)
Lin, C.C., *See* Ruiz, C.P., 14:35991
Lin, C.S., Spacecraft charging potential during electron-beam injections into space plasmas, 14:37783 (J;US)
Lin, D., *See* Yan, B., 14:36529
Lindberg, S.E., [European aerosol conference and workshop on aerosol deposition to natural surfaces, Lund, Goteborg, and Stockholm, Sweden, and Oslo, Norway, August 29–September 17, 1988]: Foreign trip report, 14:37176 (R;US)
See Schaefer, D.A., 14:35924
Lindemuth, I.R., Exploding metallic foils and fuses: A computational modeling update, 14:37006 (R;US)
See Goforth, J.H., 14:37734
See Reinovsky, R.E., 14:37005, 14:37013
Lindsay, R.W., *See* White, J.D., 14:36027
Lindstroem, G., *See* Bergstroem, S., 14:37264
Lineberry, J.T., *See* Crawford, L.W., 14:36358
Ling, S.C., Advanced instrumentation for local measurement of gas-solid suspension flows: Quarterly technical progress report No. 9/10, November 1, 1988–April 30, 1989, 14:35577 (R;US)
Lipa, M., *See* Grosman, A., 14:37760
Lipfert, F.W., Characterization of painted surfaces in the United States from the perspective of potential damage from acidic deposition, 14:37163 (R;US)
Lippold, C., Cracking of Alloy 800 tubing in superheated steam sections of the solar one central receiver, 14:36591 (BA;US)
Lisenkova, L.N., *See* Poplavskij, K.K., 14:37650
Lisic, E.C., *See* Knapp, F.F. Jr., 14:37320
Lister, C.K., *See* Finnegan, D.J., 14:37311
Litke, A., *See* Adolphsen, C., 14:37096
Littleboy, A.K., *See* Berry, J.A., 14:37224
Littlechild, S., Energy privatisation, 14:36271 (R;GB)
Litvinova, G.N., *See* Bukhalova, G.A., 14:36748, 14:36788
Liu Huangfeng, Paleomagnetic study of Shanwang formation, Shandong Province, China, 14:37409 (R;XA)
Liu, C.T., *See* Horton, J.A., 14:36608
Liu, D., TEM study of diffusion-induced grain boundary migration in Ni-Cu diffusion couples, 14:36530 (BA;FR)
Liu, K.C., Noncontacting laser diffraction strain extensometer for material properties characterization at high temperatures, 14:36617 (R;US)
Liu, K.V., Pressure drop and heat transfer characteristics of nearly neutrally buoyant particulate slurry for advanced energy transmission fluids, 14:36976 (R;US)
Liu, Lon-chang, Physics with ETA mesons, 14:37510 (R;US)
Livengood, T.A., Phenomenological analysis of Jovian north auroral H_2 Lyman band emissions, 14:37428 (RA;FR)
Livingston, L., Summary of phytoplankton data for the Nelson River and Rat-Burntwood lakes, 1987, 14:37235 (R;CA)
Livolant, F., *See* Lofttus, K., 14:37251
Llambias, E., *See* Perucca, J.C., 14:37403
Lloyd, V.D., Radiological surveys of Naval Facilities on Puget Sound, 14:37278 (R;US)
Lo, T.Y., *See* Mok, G.C., 14:36894
Lobanova, N.G., *See* Lifshits, M.L., 14:36569
Loberg, B., *See* Larker, R., 14:36625
Locker, T.R., *See* Tallon, R.W., 14:36657
Lockner, T.R., *See* Stinnett, R.W., 14:37780
Loehle, C., Free life history strategies, 14:35922 (J;US)
Lofttus, D., *See* Schiller, D., 14:36359
Lofttus, K., Immobilization of unicellular marine organisms for optical characterization, 14:37251 (BA;US)
Loginov, L.A., *See* Kiyashko, V.A., 14:37057
Lojkowski, W., Common factors controlling grain and phase boundary energy, 14:36517 (BA;FR)
Effect of high pressures on the mobility of atoms in grain boundaries, 14:36516 (BA;FR)
Long, G.G., *See* Davis, G.D., 14:36461
Longmire, C., Study of coupling in Starfish, 14:37155 (R;US)
Longuemare, C., Study of atmospheric neutrino interactions with the Frejus detector, 14:37706 (R;FR)
Loo, J.A., Capillary zone electrophoresis-mass spectrometry of peptides and proteins, 14:37141 (R;US)
Electrospray ionization-mass spectrometry and tandem mass spectrometry, 14:36846 (R;US)
See Smith, R.D., 14:37143, 14:37475
See Udseth, H.R., 14:37142
Lord, W., A finite-element model for eddy-current nondestructive evaluation: Final report, 14:36086 (R;US)
Lorenz, J.C., Tectonism, subsidence, and fracturing of Mesaverde reservoirs in the Piceance basin, Colorado, 14:35602 (J;US)
See Finley, S.J., 14:35673
Lorenz, R., Managing data from a large-scale groundwater monitoring program, 14:37255 (R;US)
Lorenz, R.A., *See* Kress, T.S., 14:36110
See Norwood, K.S., 14:36184
Lorz, E., Base irradiation history and interim inspection of the KWU/CE test fuel rods of rod groups PK 1 and PK 2: The Studsvik Super-Ramp Project, 14:36013 (R;SE)
Test fuel rod fabrication and pre-irradiation characterization report, rod groups PK1, PK2 and BK7: Studsvik Super-Ramp Project, 14:35996 (R;SE)
Los Alamos National Lab., *See* Starrfield, S., 14:37437
Lott, B., *See* Jahnke, U., 14:37603
Louie, S.G., *See* Chou, M.Y., 14:36684
Love, R.G., Further studies of respiratory health of wool textile workers. Final report, October 1986-July 1988, 14:37191 (R;GB)
Loveless, R., *See* Barger, V., 14:37491
Lowen, R.W., Some aspects of Starfish, 14:37154 (R;US)
Lowenthal, D.D., *See* Muller, C.H. III, 14:36973
Lowery, P.S., *See* Altenhofen, M.K., 14:35805
Loyd, R.J., *See* Luongo, C.A., 14:36916
Lozada, D., Experimental design for non-equilibrium immiscible carbon dioxide flood, 14:35603 (RA;CA)
Lu, C., *See* Missert, N., 14:36955
Luban, M., Electron localization in one-dimensional incommensurate potentials, 14:37694 (BA;US)
Lubell, M.S., *See* Lue, J.W., 14:36929
See Zichy, J.A., 14:36915
Lucy, W., Guidelines for preparing a contractor safety plan, 14:37402 (R;US)
Ludewig, H., Small propulsion reactor design based on particle bed reactor concept, 14:36128 (R;US)
Ludlow, L., Acid rain and agricultural production in Ontario, 14:37218 (RA;CA)

Lue, J.W., Large coil task instrumentation and diagnostics, 14:36929 (J;US)
Luetken, C.A., *See* Greene, B.R., 14:37529
Luhning, R.W, *See* Haston, J.A., 14:35721
Luk'yanova, V.P., *See* Borisov, A.D., 14:37039
Luk, T.S., *See* Rhodes, C.K., 14:37463
Lukhin, A.S., *See* Krutyakov, A.N., 14:36637
Lumatainen, V.A., Observations of lake trout (Salvelinus namaycush) spawning behaviour in low pH lakes near Sudbury, Ontario, 14:37391 (R;CA)
Lundberg, T., Update: Refiners' and marketers' perspectives. What the crash of 1986 did to heavy crude economics and marketing, 14:35646 (RA;CA)
Lundy, R., *See* Strait, J., 14:36912
Luo, H.L., *See* Green, S.M., 14:36953
Luongo, C.A., Thermal-hydraulic simulation of helium expulsion from a cable-in-conduit conductor, 14:36916 (J;US)
Lupu, A.T., *See* Grishechkina, S.P., 14:36558
Luton, J.N., *See* Lue, J.W., 14:36929
Lutsko, J.F., Free energy calculation via MD: methodology and application to bicrystals, 14:36499 (BA;FR)
Lutz, A.M., Measurement of the decays K_L -> 2γ and K_S -> 2γ, 14:37575 (R;FR)
Lyadin, A.V., *See* Yakovlev, V.V., 14:36097
Lyapina, N.K., *See* Nikitin, Yu.E., 14:36839
Lycoudi, M., Neutron activation of large samples using a one milligram Californium 252 source, 14:35852 (RA;ZA)
Lyczkowski, R.W., Contribution of dynamics and erosion for small tube arrays in fluidized beds, 14:35580 (R;US)
Lydersen, E., Size distribution patterns for trace elements in waters draining a small catchment, S.E. Norway, 14:37263 (RA;NO)
Lymar', A.G., *See* Belikov, V.V., 14:37078
Lynch, M., *See* Finnegan, D.J., 14:37311
Lyngfelt, A., Modelling of sulphur dioxide capture in fluidized bed combustion, 14:35593 (R;SE)
Modelling of sulphur dioxide capture in fluidized bed combustion, 14:35594 (R;SE)
Lynn, J.E., Fifty years of nuclear fission: Nuclear data and measurements series, 14:37560 (R;US)
Lyo, S.K., Phonon-drag thermoelectric power in high magnetic fields in heterojunctions, 14:37689 (R;US)
Lyon, J.F., *See* Painter, S.L., 14:37714, 14:37715
Lyon, R.K., *See* Muzio, L.J., 14:37197
Lysell, G., *See* Bergenlid, U., 14:36093
Lytle, F.W., *See* Greeger, R.B., 14:36649
Lyudomirskaya, A.P., *See* Arkhipov, S.M., 14:36806
Lyutsko, V.A., On the kinetics of dehydration of double orthophosphate hexahydrates $MgMPO_4$, 14:36749 (RA;SU;In Russian)
See Frenkel', P.L., 14:36753

M

Ma Fei, *See* Niu Lin, 14:35747
MacDonald, P.E., *See* Batt, D.L., 14:36053
MacGillivray, J.R., Resource characterization of the central region of the lower Cretaceous McMurray/Wabiskaw deposit, Athabasca oil sands area, northeastern Alberta, 14:35699 (RA;CA)
See Keith, D.A.W, 14:35694
Machado, P., Optimum cementing and gravel packing methods for unconsolidated heavy oil sands, 14:35710 (RA;CA)
Machida, S., *See* Raparia, D., 14:37035
Machida, Shinji, The beam tracking during the first few milliseconds of a low energy booster, 14:37048 (R;US)
MacInnes, C., Basement condensation. Field study of new homes in Winnipeg, 14:36400 (R;CA)
Mackay, W., *See* Newberger, B., 14:37049
MacKay, W.W., *See* Swenson, C.A., 14:37034
Mackenzie, P.B., Machines for lattice gauge theory, 14:37549 (R;US)
MacKenzie, R.A.D., Grain boundary structure in Ni_3Al, 14:36492 (BA;FR)
Macklin, L.L., *See* Fleissner, J.G., 14:35843
MacPhee, D.G., *See* Williams, J.H., 14:37349
MacPherson, R.W., Superconductivity. Recent developments and defence applications (U), 14:36666 (R;CA)
Mader, W., Present limitations on the lattice imaging of grain boundaries, 14:37668 (BA;FR)
Madey, T.E., Structure and reactivity of chemisorbed species and reaction intermediates: Progress report, December 1, 1984–November 30, 1985, 14:36742 (R;US)
Maestre, M.F., *See* Lofftus, K., 14:37251
Maggs, A.C., Pair potential approach for interfaces: fundamental problems and practical solutions, 14:37666 (BA;FR)
Maglevannyj, I.I., *See* Trukhanov, G.Ya., 14:36080
Magnuson, T., *See* Niswander, L., 14:37314
Magomedbekov, Eh.P., *See* Andreev, B.M., 14:36814
Magsig, C.T., *See* Zeller, A.F., 14:36917
Magunov, R.L., *See* Nadzharyan, K.A., 14:36810
Magyar, M., *See* Spilrain, E.E., 14:35605
Mahale, N.K., *See* Goderre, G.P., 14:37050
Maher, J.V., The physics of pattern formation at liquid interface: Progress report, June 1, 1988–May 31, 1989, 14:37664 (R;US)
Maini, B., *See* Coskuner, G., 14:35726
Maison, J.M., *See* Langevin-Joliot, H., 14:37588
Maix, R.K., Manufacture and testing of 465 km superconducting cable for the HERA dipole magnets, 14:36919 (J;US)
Malya, P.S., Stress corrosion cracking susceptibility of types 316NG and 316 stainless steel in BWR-type environments, 14:36593 (BA;US)
Majorov, L.V., *See* Gomin, E.A., 14:36076
Maksimova, L.G., Study of physicochemical properties of alkali metal salts of 12-tungstogallic acid, 14:36768 (RA;SU;In Russian)
Malashonok, I.E., Infrared absorption spectra of rare alkali metal phosphates, 14:36752 (RA;SU;In Russian)
Malatzky, A., Taking charge of electricity costs, 14:36318 (RA;US)
Maley, M., *See* Takigawa, Masashi, 14:36642
Maley, M.P., Low contact-resistivity junctions to ceramic superconductors, 14:36945 (J;US)
See Ott, K.C., 14:36639
Malhotra, R., *See* Hirschon, A.S., 14:35527
See McMillen, D.F., 14:35521, 14:35531
Malinauskas, A.P., [International conference on Thermal reactor safety, October 2-7, 1988, Avignon, France]: Foreign trip report, 14:36167 (R;US)
Mallin, M.A., Postwar US conventional military policy: Lessons and implications for the seventh era and beyond, 14:36457 (R;US)
Malone, P.G., *See* Boyer, C.M., 14:35681
Malone, T.P., Field evaluation of new exterior video motion detection systems, 14:36892 (R;US)
Malov, L.A., *See* Boneva, S.T., 14:37633
Mancini, E.A., Establishment of an oil and gas database for increased recovery and characterization of oil and gas carbonate reservoir heterogeneiity: Technical progress report, April 19, 1989–June 30, 1989, 14:35600 (R;US)
Mandryk, A.N., *See* Borisov, A.D., 14:37039
Mann, R.C., *See* Culioli, J.C., 14:37799
See Wehe, D.K., 14:37816
Manning, F.M., *See* Minarick, J.W., 14:36173
Manson, S.T., Multiple ionization of xenon by proton impact, 14:37462 (R;US)
Mansour, M.N., Development of a pulsed coal combustor fired with CWM [coal-water mixture]: Phase 3, Final report, 14:35582 (R;US)
Mansour, N.A., Measurements of solids concentrations in coal slurries using microwaves, 14:35550 (R;CA)
See Pal, R., 14:37132
Mantsch, P., *See* Strait, J., 14:36912
Manzione, M.A., Trace metal removal by iron coprecipitation: Field evaluation: Final report, 14:35960 (R;US)
Mao, D., *See* Yan, B., 14:36529
Maraschi, L., *See* Treves, A., 14:37431
Marchuk, Yu.V., *See* Sarychev, V.A., 14:36020
Marcinkowski, A., MSC calculations with use of EMPIRE, 14:37617 (RA;XA)
Marcus, P.S., Nonlinear hydrodynamical innstabilities, transitions, and coherent features: Final report, 14:37487 (R;US)

Mardirosova, I.V., Phase diagram of the system $RbPO_3$-V_2O_5, 14:36747 (RA;SU;In Russian)
See Bukhalova, G.A., 14:36748
See Dzeranova, K.B., 14:36797
Marinus, N., *See* Walker, N., 14:37187
Marion, J., *See* Eimerl, D., 14:36682
Marion, J.E., Fracture mechanisms and strengthening of slab lasers, 14:36683 (BA;US)
Marken, K.R., *See* Gregory, E., 14:36938
Marken, K.R. Jr., *See* Collings, E.W., 14:36653
Markin, J.T., *See* Dreicer, J.S., 14:37807
Marklund, G.T., Snapshots of high-latitude electrodynamics using Viking and DMSP f7 observations, 14:37447 (R;US)
Markovich, P.K., *See* Shepard, K.W., 14:37069
Markovskij, B.L., *See* Vinitskij, S.I., 14:37705
Markowski, R.S., ASQC support of the quality profession in the utility industry - is it sufficient?, 14:36060 (RA;US)
Markworth, A.J., *See* Collings, E.W., 14:36653
Marland, G., Estimates of CO_2 emissions from fossil fuel burning and cement manufacturing, based on the United Nations energy statistics and the US Bureau of Mines cement manufacturing data, 14:37173 (R;US)
Marmolino, C., *See* Gomez, M.T., 14:37422
Marott, A., Use of slant drilling techniques for exploitation of Venezuela's shallow reservoir, 14:35606 (RA;CA)
Marques, E.C., *See* Greeger, R.B., 14:36649
Marsh, P., NOGAP C-11A. Sediment regime of lakes in the Mackenzie Delta, 14:37234 (R;CA)
Marsh, S.P., *See* Fowler, C.M., 14:37010
See Goforth, J.H., 14:37007, 14:37734
See Rickel, D.G., 14:37011
Marshall, B.B., Nonfilm radiography at the Oak Ridge Y-12 Plant, 14:37121 (R;US)
Marshall, D.B., Interfaces and toughening in ceramics, 14:36619 (BA;FR)
Transformation toughening of ceramics. Final report, 1 September 1985-31 August 1988, 14:36612 (R;US)
Marston, P.G., Advanced superconducting MHD magnet design for a retrofit power plant, 14:36918 (J;US)
Martens, J.S., A film transmission line resonator to measure the microwave surface resistance of $YBa_2Cu_3O_{7-x}$, 14:36901 (J;US)
Design of variable phase velocity kinetic inductance delay lines and their measured characteristics when fabricated by a simple Nb based process, 14:36904 (J;US)
Single superconducting thin film devices for applications in high T_c materials circuits, 14:36898 (J;US)
Martin, B., Effects of air pollutants on the composition of stable carbon isotopes $\delta^{13}C$, of leaves and wood, and on leaf injury, 14:37396 (J;US)
Martin, J.A., *See* Cross, J.B., 14:36844
Martin, N.E., *See* Sharitz, R.R., 14:37213
Martin, W.R., *See* Wehe, D.K., 14:37816
Martin-Scott, S.Y., *See* Scott, J.D., 14:35628
Martindale, A.A., *See* Webb, J., 14:37348
Martinez, A.R., *See* Hodgdon, M.L., 14:37480
Martino, L., *See* Chiu, S., 14:35779
Marty, N., Isovector and isoscalar spin-flip excitations in even-even s-d shell nuclei excited by inelastic proton scattering, 14:37630 (R;FR)
Martynenko, P.A., *See* Belikov, V.V., 14:37078
Martynov, M.I., *See* Antipov, S.P., 14:37768
Marugin, V.V., *See* Belov, V.V., 14:36776
Marwick, A.D., The structure of the boron-hydrogen complex in silicon, 14:36695 (BA;US)
Marx, J., *See* Bongartz, R., 14:36157
Mashneva, N.I., Combined effect of incorporated ^{90}Sr, alcohol, and tobacco smokes on reproduction of warm-blooded animals, 14:37372 (RA;SU;In Russian)
Maskrey, J.T., *See* Read, P.M., 14:37466
Masloboev, V.A., Condensed phosphates of rare earth and rare alkali elements, 14:36751 (RA;SU;In Russian)
Maslov, V.A., *See* Vdovin, S.A., 14:37722
Maslov, V.M., *See* Klepatskij, A.B., 14:37625
Maslov, V.P., *See* Belavkin, V.P., 14:37704
Mason, R.J., Numerical simulation of plasma opening switches, 14:37806 (R;US)
Mason, R.S. Jr., Power quality: a utility perspective, 14:36320 (RA;US)
Masounave, J., *See* Mirza, J., 14:36679
Massoletti, D., *See* Fields, D.J., 14:37600
Masson, P., *See* Fedoroff, N., 14:37287
Masuda, Kohzoh, Ion beam applications in MeV region, 14:37684 (RA;JP;In Japanese)
Masuda-Jindo, K., Electronic theory for grain boundary segregation and embrittlement of intermetallic compound Ni_3Al, 14:36518 (BA;FR)
Masuda-Jindo, K.I., *See* Larere, A., 14:36509
Masuko, Yoji, *See* Komori, Junko, 14:36723
Mathews, G.J., *See* Meyer, B.S., 14:37636
Mathews, J.F., *See* Pepper, J.M., 14:35862
Matijasevic, V., *See* Missert, N., 14:36955
Matkowsky, B.J., *See* Bayliss, A., 14:36867
Matrosova, V.A., *See* Bukhalova, G.A., 14:36748
Matson, C.F., *See* Robinson, N.A., 14:37328
Matsuda, S., Super high-speed magnetically levitated system approaches: practical use, 14:36404 (R;JP)
Matsuura, Kiyokata, Experimental data processing techniques by a personal computer, 14:37804 (R;JP;In Japanese)
Matter, J.C., A demonstration of ASSESS: Analytic System and Software for Evaluating Safeguards and Security, 14:35850 (R;US)
Matteucci, F., *See* Raymond, J.C., 14:37430
Mattison, B.W., The McMurray formation in the Athabasca oil sands area: an ichnological and paleontological perspective, 14:35695 (RA;CA)
Mattison, T., *See* Haiessinski, J., 14:37066
Mattox, D.M., *See* Dreike, P.L., 14:37775
Mau, T.K., Role of alpha particle damping in fast wave current drive and heating, 14:37744 (R;US)
Maurer, R., Hetero phase boundaries in the silver-nickel system, 14:36515 (BA;FR)
Maxon, H., *See* Abrahamson, S., 14:37380
Mayall, B.H., *See* Poggio, A.J., 14:37303
Mayer, C.L., *See* Kerfoot, H.B., 14:37221
Mayer, W.A., *See* Evans, R.G, 14:35744
Mayergoyz, I.D., *See* Booske, J.H., 14:36961
Mayfield, N.E., Effective transition from panel board to CRT-based process control, 14:35776 (RA;US)
Mayo, D.E., *See* Thompson, R.G., 14:36513
Mazarakis, M.G., *See* Wagner, J.S., 14:37093
Mazitov, R.K., NMR study of interactions of rare alkali metal ions (Li^+ and Cs^+) with Co^{2+} and Ni^{2+} in aqueous solutions, 14:36802 (RA;SU;In Russian)
Mazur, P.O., *See* Strait, J., 14:36912
Mazurkiewicz, M., Coal disintegration by high-pressure waterjet: Final report, 14:35514 (R;US)
McAnulty, P.C., *See* Stone, S.K., 14:36057
McArthur, R.D., Nevada Test Site Radionuclide Inventory and Distribution Program: Report number 5: Areas 5, 11, 12, 15, 17, 18, 19, 25, 26, and 30, 14:35780 (R;US)
McCallum, J.C., *See* Sklad, P.S., 14:36618
McCallum, R.W., *See* No, K., 14:36947
McCandless, B.E., *See* Birkmire, R.W., 14:35911
McCarthy, J.M., *See* Muzio, L.J., 14:37197
McCauley, W., Computer based training state of the art systems, 14:35826 (RA;US)
McClaine, A.W., Strategies for combatting problems caused by cathode slag shorting, 14:36353 (BA;US)
See Pian, C.C.P., 14:36351, 14:36354
McClelland, L.A., Residential domestic water heating advisory computer program. Vol. 2, computer user's guide. Vol. 3, programmer's guide, 14:36372 (R;CA)
Residential domestic water heating advisory computer program. Vol. 1, technical report, 14:36373 (R;CA)
McClintock, J.E., *See* Shrader, C.R., 14:37433
McCollister, H.L., *See* Dreike, P.L., 14:37775
McConnell, D., Evaluation of commercially available lighting design software, 14:36397 (R;US)

McCormack, J.D., Submerged gravel scrubber demonstration tests: Performance of a large-scale unit, 14:36029 (R;US)
See Hilliard, R.K., 14:36028
See Muhlestein, L.D., 14:36187
McCormack,M.E., *See* Gray, L.G.S., 14:36468
McCormick, J.F., *See* Hoffman, F.O. Jr., 14:37385
McCown, A.W., *See* Eden, J.G., 14:36968
McDaniel, D.H., *See* Moore, W.B., 14:37016
See Rochau, G.E., 14:37774
McDonald, I.G., *See* Batten, J.J., 14:36463
McDonald, J.F., Evidence of host-mediated regulation of retroviral element expression at the posttranscriptional level, 14:37312 (RA;US)
McDonald, J.M., *See* Langley, R.A., 14:37045
McDonald, T.E., *See* Harris, D.B., 14:37770
McDougal, C.D., *See* Rochau, G.E., 14:37774
McDougall, A.R., Wood-fired boiler feasibility study. Western Memorial Regional Hospital Corner Brook, Newfoundland, 14:35867 (RA;CA)
McDowell, R.S., *See* Palmer, B.A., 14:37138
McElhaney, S.A., *See* Chiles, M.M., 14:37133
McEntee, K., Effects of DNA damage on transcription and transposition of Ty retrotransposons of yeast, 14:37386 (RA;US)
McFall, K.S., *See* Haas, M.R., 14:35672
McGee, B.C.W., A pressure observation well for monitoring and optimizing the pressure-up blowdown combustion process, 14:35711 (RA;CA)
McGee, J., The Jobo Steamflood Project: A preliminary evaluation of results, 14:35615 (RA;CA)
McGinnis, D.P., *See* Martens, J.S., 14:36898, 14:36901, 14:36904
McGrath, M.A., Jovian equatorial H_2 emission from 1979-1987, 14:37427 (RA;FR)
McGrorty, S., *See* Goss-Custard, J.D., 14:35945
McHargue, C.J., *See* Sklad, P.S., 14:36618
McHenry, M.E., *See* Ott, K.C., 14:36639
McIntosh, R.A., *See* Beckie, K.N., 14:35696
McInturff, A., *See* Strait, J., 14:36912
McInturff, A.D., *See* Hanft, R.W., 14:36921
See Herrup, D.A., 14:36920
See Zeller, A.F., 14:36917
McIsaac, C.V., Results of surface activity and radiation field measurements made during surface decontamination experiments conducted at TMI-2, 14:36194 (BA;US)
See Horan, J.T., 14:36193
McKay, L.B., Marine biomass: New York State species and site studies. Annual report December 1982-November 1983, 14:35906 (R;US)
McKay, P.F., Ion production on the PI-110A accelerator, 14:37776 (R;US)
McKee, J.E., High-sulfur spray dryer Shawnee test program: Characterization of 10-MW spray-dryer electrostatic precipitator by-product: Final report, 14:35963 (R;US)
McKenzie, L.J., *See* Wall, T.J., 14:36139
McKernan, S., *See* Carter, C.B., 14:36626
See Cho, N.H., 14:36670
McKinley, T., *See* White, A., 14:35825
McLaughlin, S.B., *See* O'Neill, E.G., 14:37336
McLaughlin, S.B. Jr., [Fifth international congress of plant pathology, Kyoto, Japan, August 23–27, 1988]: Foreign trip report, 14:37175 (R;US)
McLaughlin, W.L., *See* Barrett, J.H., 14:37100
McLeod, K.W., *See* Donovan, L.A., 14:35916
McLuckey, S.A., Explosives detection with an ion trap mass spectrometer, 14:37148 (R;US)
McMahon, C.J. Jr., *See* Menyhard, M., 14:36510
McMillen, D.F., Factors controlling hydrogenolysis in coal liquefaction: Quarterly report No. 6 for the period October 1–December 31, 1987, 14:35531 (R;US)
The chemical origin of synergy in liquefaction and co-processing, 14:35521 (R;US)
See Hirschon, A.S., 14:35527
McNamara, N., *See* Struckmeyer, R., 14:37228
McNatt, J.D., *See* TenWolde, A., 14:36378
McNeil, W.J., *See* Lai, S.T., 14:37750
McPherson, D.W., *See* Knapp, F.F. Jr., 14:37320
Mead, S.W., *See* McArthur, R.D., 14:35780
Mecking, B., *See* Brindza, P., 14:36934
See O'Meara, J., 14:36942
Mehlhorn, T.A., *See* Stinnett, R.W., 14:37780
Mehrotra, R., *See* Janakiram, V.K., 14:37794
Mehta, H.S., *See* Sindelar, R.L., 14:36126
Mei, Y., *See* Green, S.M., 14:36953
Meier, G.H., *See* Kim, G.M., 14:35538
Melke, A., Specimen cage modification for TEM in-situ shearing, 14:36693 (BA;US)
Meister, G., *See* Bongartz, R., 14:36157
Mel'nichenko, E.I., Interaction of ammonium fluoroyttrates with lithium salts, 14:36783 (RA;SU;In Russian)
Mel'nikov, P.P., Electric conductivity of ternary phosphates and vanadates of alkali and rare earth metals, 14:36746 (RA;SU;In Russian)
See Komissarova, L.N., 14:36745
Mel'nikova, R.Ya., *See* Malashonok, I.E., 14:36752
Mel'nikova, T.N., Thermal properties of solid rubidium and cesium, 14:36557 (RA;SU;In Russian)
Meldau, R.F., Reducing wellbore heat loss, 14:35623 (RA;CA)
Melkumyants, M.V., Kinetics of lithium niobate interaction with molten ammonium hydrodifluoride, 14:36773 (RA;SU;In Russian)
Melroy, O.R., *See* Kortright, J.B., 14:36854
Mendel, C.W., *See* Rochau, G.E., 14:37774
Menlove, H.O., Remote-controlled NDA [nondestructive assay] systems for feed and product storage at an automated MOX [mixed oxide] facility, 14:35757 (R;US)
Menon, P., Indoor spatial monitoring of combustion-generated pollutants (TSP, CO, and BAP) by Indian cookstoves, 14:37162 (R;US)
Mensing, R.W., A probabilistic method for estimating system susceptibility to HPM, 14:37131 (R;US)
Menyhard, M., Bismuth segregation in Cu-Bi bicrystals, 14:36510 (BA;FR)
Menzer, R.E., *See* Fraval, F.D., 14:36407
Merdinger, J.C., *See* Bourgeois, C., 14:37591
See Vivien, J.P., 14:37586
Mergelyan, O.S., *See* Zakharov, N.A., 14:36809
Merkle, K.L., Core structure of CSL boundaries in NiO, 14:36627 (BA;FR)
Merkushev, G.N., Experimental model of radiation injuries of liver, 14:37359 (RA;SU;In Russian)
Merrill, D.T., *See* Manzione, M.A., 14:35960
Merten, W.N., Roofbolt support in board and pillar workings, 14:35576 (R;ZA)
Mertens, J., *See* Bongartz, R., 14:36157
Meshcheryakov, N.M., *See* Skorovarov, D.I., 14:36864
Messina, C., *See* Interrante, G.C., 14:35820
Metting, N.F., *See* Toburen, L.H., 14:37663
Meyer, B.S., Fission barriers for r-process nuclei and implications for astrophysics, 14:37636 (R;US)
Meyer, M., *See* Genevey, J., 14:37581
Meyer, O., Ion beam modification and analysis of thin $YBa_2Cu_3O_7$ films, 14:36677 (R;DE)
Meyers, P.V., Polycrystalline cadmium telluride n-i-p solar cell: Annual subcontract report, 1 June 1987–31 August 1988, 14:35912 (R;US)
Meyers, S., Proceedings of the Chinese-American symposium on energy markets and the future of energy demand, 14:36258 (R;US)
Meyn, V., *See* Murtada, H., 14:35604
Michaels, A.I., *See* Breger, D.S., 14:36198
Michie, R.B., *See* Raymond, T.D., 14:36972
Midgley, D., Determination of boron as boric acid by automatic potentiometric titration, 14:36704 (R;GB)
Miedema, A.K., Influencing customer investment through financial incentives, 14:36316 (RA;US)
Migalov, I.V., Reactor power stabilization using a discrete control system, 14:36100 (RA;SU;In Russian)
Miglin, M.T., Microstructure and stress corrosion resistance of alloys X-750, 718, and A-286 in LWR environments: Final report, 14:36544 (R;US)
Mikhajlov, I.N., Dipole octupole correlations in a boson model and evidence for their existence in nuclei, 14:37631 (R;SU)

Mikhajlov, K.V., *See* Szaro, S., 14:37115
Mikhajlov, V.A., *See* Torgov, V.G., 14:36863
Mikhajlova, N.L., *See* Baldova, M.V., 14:36786
Mikheev, M.V., *See* Skorovarov, D.I., 14:36864
Mikheeva, T.M., Catalytic activity in reactions of isotopic exchange of carbon monoxide and adsorption properties of catalysts on zinc oxide base, 14:36815 (RA;SU;In Russian)
Mikkelson, K.A., *See* Sanford, T.W.L., 14:37092
Mikula, R.J., Coal dustiness: characterization and control, 14:35549 (R;CA)
Mikulski, J., *See* Kulawik, I., 14:36825
Mildner, D.F.R., *See* Carpenter, J.M., 14:37097
Millbank, N., *See* Diamond, L., 14:36255
Miller, D.W., *See* Williams, J.S., 14:36886
Miller, J.C., *See* Smith, D.B., 14:37464
Miller, J.D., *See* Langan, S.J., 14:37261
See Yang, Y.J., 14:35718
Miller, J.F., *See* DeLuca, W.H., 14:36221
Miller, J.R., *See* Gibson, C.R., 14:36930
See Henning, C.D., 14:36909
See Strum, M.J., 14:36948
See Summers, L.T., 14:36931
Miller, R.L., Low severity co-processing using homogeneous basic nitrogen promotors, 14:35641 (J;US)
Miller, W.A., *See* Liu, D., 14:36530
Mills, A.W., The development of Mod N-80HO casing for cyclical steam stimulation, 14:36470 (RA;CA)
Mills, F.E., *See* Palkovic, J.A., 14:37051
Mills, M., Woodchip conversion project report. Newfoundland Hardwoods Clarenville plant and Clarenville district vocational school, 14:35868 (RA;CA)
Mills, M.J., Structure of asymmetrical tilt boundaries formed during creep of (112) oriented aluminum single crystals, 14:36493 (BA;FR)
Milne, B.T., *See* Gardner, R.H., 14:37211
Milne, T.A., *See* Evan, R.J., 14:36442
Mimaki, T., Effect of grain-boundary structure on stress corrosion cracking in αCu-Al alloy bicrystals, 14:36536 (BA;FR)
Minarick, J.W., Accident sequence precursor program: Methods improvements and current results, 14:36173 (BA;DE)
Minato, Kazuo, *See* Namba, Takashi, 14:36022
Minehart, R., *See* Gross, F., 14:37569
Mingay, D.W., *See* Prozesky, V.M., 14:37584
Minina, O.B., *See* Prokof'ev, O.N., 14:37648
Minker, J., Parallel problem-solving system, PRISM (Parallel Inference System). Final report, November 1986-February 1988, 14:37796 (R;US)
Minkoff, M., *See* Bayliss, A., 14:36867
Minonishi, Y., Structure of small angle tilt boundaries and their behavior under the applied shear stresses in fcc metals, 14:36531 (BA;FR)
Mioduszewski, P.K., *See* Langley, R.A., 14:37758
Miralles, N., *See* Figuerola, E., 14:36840
Mirenkov, A.F., *See* Bol'shakov, V.I., 14:36017
Miro, J., *See* Teschendorff, V., 14:36152
Mirza, J., Abrasion-erosion resistance of various repairing mortars, 14:36679 (R;CA)
Mishchenko, V.T., *See* Nadzharyan, K.A., 14:36810
Mishima, Y., *See* Brown, J.K., 14:37350
Mishnev, S.I., *See* Young, L., 14:37572
Missert, N., In situ growth of superconducting YBaCuO using reactive electron-beam coevaporation, 14:36955 (J;US)
Mitchell, W.J., *See* Parr, B.F., 14:37189
Miura, G.A., *See* Robinson, N.A., 14:37328
Miura, S., Effect of the triple junction on grain-boundary sliding in aluminum tricrystals, 14:36524 (BA;FR)
See Mimaki, T., 14:36536
Miyakita, K., *See* Noji, K., 14:35986
Mizrokhi, I.J., *See* Tchurikov, N.A., 14:37307
Mizuno, M., *See* Otsuki, A., 14:36519
Mock, R., *See* Sanford, T.W.L., 14:37092
Moeller, R., TEGENA: Detailed experimental investigations of temperature and velocity distributions in rod bundle geometries with turbulent sodium flow, 14:36032 (R;DE;In German)
Moeller, S.V., Experimental study of the phenomena of turbulent flow in the narrow gaps between subchannels of rod bundles, 14:36033 (R;DE;In German)
Moffett, D., *See* Averill, D.W., 14:35787
Mohrbacher, D.A., *See* Hoffman, F.O., 14:37203
Moisan, C., *See* Pouliot, J., 14:37599
Mok, G.C., The analysis of lead slump effects in shipping casks for radioactive materials, 14:36894 (R;US)
Mokhosoev, M.V., Interaction of thallium (1) and lithium molybdates (tungstates), 14:36766 (RA;SU;In Russian)
See Batueva, I.S., 14:36765
See Korsun, V.P., 14:36760
Mokrousova, Eh.V., Number of roentgenological procedures per one X-ray examination as quality index roentgenodiagnosis, 14:37656 (RA;SU;In Russian)
Molden, J.E., Research in operations: lessons learned, 14:36134 (RA;US)
Moldovan, Z., *See* Culea, M, 14:37469
Molley, P.A., *See* Stalker, K.T., 14:37020
Monaco, R., *See* Kautz, R.L., 14:36906
Monaghan, P.F., Storage of off-peak electrical energy in building floors with particular reference to resistance heating and heat pump systems, 14:36214 (RA;CA;In English and French)
Monakhov, A.S., Biological effects of ^{137}Cs, incorporated into organism of rats, 14:37367 (RA;SU;In Russian)
Mondragon, J., *See* Paulus, W.K., 14:35848
Monger, T.G., Cyclic CO_2 injection for light oil recovery: Performance of a cost shared field test in Louisiana: Second quarterly report, 21 February–21 May 1989, 14:35632 (R;US)
Mongkolsuk, S., *See* Singer, M.F., 14:37288
Monnehan, G.A., *See* Freeman, R.M., 14:37576
Monson, R., *See* White, J.D., 14:36027
Montano, P.A., Structure of Ag, Fe and Ge microclusters, 14:37477 (J;DE)
Month, M., Physics of particle accelerators: Volume 1, 14:37026 (B;US)
Physics of particle accelerators: Volume 2, 14:37027 (B;US)
Monty, C., *See* Tabet, N., 14:36532
Moody, J.L., Trajectory analysis of nine years of precipitation chemistry in Charlottesville, Virginia: Final report, 14:37165 (R;US)
Moolj, J.E., *See* Missert, N., 14:36955
Mooney, W.L. III, Management of training counting beans or demonstrating results, 14:35828 (RA;US)
Mooradian, A., *See* Zayhowski, J.D., 14:36960
Moore, B.T., *See* Batten, J.J., 14:36463, 14:36464
Moore, C., Fitness for duty in the nuclear power industry: A review of technical issues, 14:36162 (R;US)
Moore, K.J., *See* Strobel, M.C., 14:37306
Moore, M., *See* Paulus, W.K., 14:35848
Moore, M.A., *See* Garrett, W.R., 14:37465
Moore, R.H., *See* Dreike, P.L., 14:37775
Moore, T., Onshore federal reservoir management program and the relationship to heavy crude and tar sands in California, 14:35742 (RA;CA)
Moore, W.B., Numerical analysis of experimental data to infer plasma opening switches, 14:37016 (R;US)
Moore, W.B.S., *See* Rochau, G.E., 14:37774
Moos, H.W., *See* Livengood, T.A., 14:37428
See McGrath, M.A., 14:37427
Moreau, C., *See* Champagne, B., 14:36646
See Parent, L, 14:36645
Morera, J.P., *See* Ghendrih, P., 14:37719
Morgan, D.J., *See* Titus, S.J., 14:35907
Morgan, G.H., Optimization of multiwire coil ends having 45 degree bends, 14:36924 (J;US)
Morgan, M.A., The dynamics of charged particles in the near wake of a very negatively charged body, 14:37785 (J;US)
Mori, Y., *See* Alton, G.D., 14:37467
Morimoto, H., Tritium labeling by thermally generated tritons, 14:36845 (R;US)
Morisato, D., *See* Roberts, D., 14:37304
Morjean, M., *See* Jahnke, U., 14:37603
Mork, B.J., *See* Scheeline, A., 14:37746
Morlet, M., *See* Marty, N., 14:37630

Morofsky, E., Cooling with ice. Canadian progress, 14:36204 (RA;CA;In English and French)
Morosin, B., *See* Venturini, E.L., 14:36584, 14:36647
Moroz, V.I., *See* Arakelian, S.G., 14:37520, 14:37521
Morozov, V.G., Conversion methods for complex fluorides of rare alkali elements, 14:36803 (RA;SU;In Russian)
See Baldova, M.V., 14:36786
Morris, J., *See* Comaskey, B., 14:36969
Morris, J.R., *See* Chambers, D.H., 14:37486
Morris, J.W. Jr., *See* Tribula, D., 14:36574
Morsad, A., *See* Freeman, R.M., 14:37576
Morsch, A., *See* Korn, D., 14:36541
Mort, M., *See* Kolasa, J., 14:37277
Morton, J., *See* Wood, J.D., 14:36586
Moschopedis, S.E., Investigation in the use of heavy oils (and derivatives) to process coal, 14:35518 (RA;CA)
Moscov, A.S., *See* Spilrain, E.E., 14:35605
Moseev, A.L., *See* Artem'ev, N.I., 14:36074
Moshier, W.C., *See* Davis, G.D., 14:36461
Mosko, S.W., *See* Olsen, D.K., 14:37044
Mott, J.E., *See* Sackett, J.I., 14:36109
Mougey, J., *See* Brindza, P., 14:36934
See Tuzel, W., 14:36937
Mountford, M.M., *See* Brown, J.K., 14:37350
Mowrer, G.R., *See* Moore, W.B., 14:37016
See Rochau, G.E., 14:37774
Moya, J., *See* Machado, P., 14:35710
Mozgovoj, A.G., Experimental study of density of liquid cesium - sodium, potassium alloys, 14:36554 (RA;SU;In Russian)
Experimental study of phase equilibrium of liquid - vapor for cesium - sodium, potassium alloys, 14:36553 (RA;SU;In Russian)
See Mel'nikova, T.N., 14:36557
Mozhaev, A.A., *See* Yakovlev, V.V., 14:36097
Muehlhauser, J.W., *See* Attig, R.C., 14:36349
Mueller, J.R., Degree education on-site, on-line, on-time, 14:36066 (RA;US)
Mueller, M., Subcritical crack growth in metal-ceramic-interfaces, 14:36986 (BA;FR)
Mueller, N., UW 21/123 monoclonal antibody in the radioimmunological detection of tumour tissue in the head and neck region, 14:37318 (R;DE;In German)
Mughabghab, S., *See* Ludewig, H., 14:36128
Muhl, P., *See* Aurich, J., 14:36832
Muhlestein, L.D., LWR aerosol containment experiments (LACE) program and initial test results, 14:36187 (BA;US)
Muirhead, D., *See* Sanford, T.W.L., 14:37092
Muirhead, M., *See* Love, R.G., 14:37191
Muller, C., *See* Haas, F., 14:37071
Muller, C.H. III, Coherent VUV laser at 130nm, 14:36973 (BA;US)
Mullet, R.D., Use of nuclear material control specialists for material surveillance, 14:35844 (R;US)
Munkueva, S.D., *See* Mokhosoev, M.V., 14:36766
Murad, E., *See* Lai, S.T., 14:37750
Muramatsu, Ken, Analysis of the CSNI/GREST core concrete interaction chemical thermodynamic benchmark exercise using the MPEC2 computer code, 14:35993 (R;JP)
Murao, Yoshio, *See* Iwamura, Takamichi, 14:36010
Murata, K.K., *See* Williams, D.C., 14:36189
Murdock, B., *See* Chin, D.K., 14:36899
Murinov, Yu.I., *See* Nikitin, Yu.E., 14:36839
Murphree, J.S., *See* Marklund, G.T., 14:37447
Murphy, C.E. Jr., Measurement of SO_2 uptake and redistribution of sulfur in a pine canopy using ^{35}S, 14:35921 (J;US)
Murphy, E.S., *See* Rogers, V.C., 14:35786
Murphy, J., Synchrotron light source data book, 14:37030 (R;US)
Murphy, J.A., *See* Benjamin, A.S., 14:36177
Murphy, P.G., Long-term recovery of northern hardwood forest following gamma irradiation, 14:37337 (J;US)
Murray, J.E., Multi-segment Nd:Glass disk amplifiers, 14:37782 (R;US)
Murray, J.J., *See* Haiessinski, J., 14:37066
Murray, M., The effects of snow on landmarks in K_u band SAR images, 14:37144 (R;US)
Murray, R.C., *See* Cummings, G.E., 14:36169
See Wells, J.E., 14:36171
Murtada, H., Heavy oil recovery through immiscible displacement by carbon dioxide, 14:35604 (RA;CA)
Murtha, J.A., Reservoir Engineering and Treatment Design Technology. Annual report, December 1987-November 1988, 14:35676 (R;US)
Muzio, L.J., Errors in grab sample measurements of N_2O from combustion sources, 14:37197 (J;US)
Myburgh, I.S., Performance and durability evaluation of a Moteurgaro engine fueled with ethanol, 14:36450 (R;ZA)
See Falk, R.S., 14:36444
Myers, S.M., Ion-beam studies of hydrogen-metal interactions, 14:36606 (J;NL)
Myrick, S., *See* Solbes, A., 14:36355
Mumit oller, P., *See* Meyer, B.S., 14:37636

N

N 14 Collaboration, *See* Roudeau, P., 14:37554
Naderi, N., *See* Theriault, D.J., 14:35701
Nadji, A., *See* Haas, F., 14:37071
Nadzhakov, E.G., *See* Mikhajlov, I.N., 14:37631
Nadzharyan, K.A., Study of the system LiC_2H_5COO-$Y(C_2H_5COO)_3$-H_2O at 25 deg C, 14:36784 (RA;SU;In Russian)
Synthesis and analysis of high-pure lithium iodate monocrystals, 14:36810 (RA;SU;In Russian)
Naidu, H.G., Survey of microprocessor based performance monitoring devices in Canadian surface coal and oil sands mines in 1987, 14:35572 (R;CA)
Nair, R.P.K., ECIS - Adaptation to CDC CYBER system, 14:37801 (R;BR;In Portuguese)
See Seehusen, J., 14:36068
Nakagome, Yoshihiro, *See* Block, R.C., 14:37605
Nakaiwa, M., *See* Akiya, T., 14:36216
Nakamura, T., *See* Kress, T.S., 14:36110
Nakano, Yukihiro, *See* Takeuchi, Takayuki, 14:36722
Nakao, H., *See* Matsuda, S., 14:36404
Nakata, S.-I., *See* Takatsuka, T., 14:35635
Nakazaki, Shinobu, *See* Hashino, Tasuke, 14:37731
Nakshbandi, Kh., *See* Yakimova, E.E., 14:36710
Namba, Takashi, Study on the reaction between SiC and Pd, (2), 14:36022 (R;JP;In Japanese)
Namboodiri, M.N., *See* Fields, D.J., 14:37600
Nambu, Yasusada., Stochastic dynamics of an inflationary model and initial distribution of universes, 14:37443 (R;JP)
Nanda, S., *See* Tuzel, W., 14:36937
Nanstad, R.K., *See* Cheverton, R.D., 14:36006
See Haggag, F.M., 14:36475, 14:36984
See Iskander, S.K., 14:36082
Napoli, S., *See* Menlove, H.O., 14:35757
Napolitano, J., *See* Young, L., 14:37572
Narayan, J., Critical phenomenon and segregation behavior at interfaces and subgrain boundaries, 14:36540 (BA;FR)
Narbutt, J., Outer-sphere hydration of metal chelates and its role in liquid-liquid partition equilibria, 14:36821 (RA;SU)
Nariai, Hidekazu., On a quantized scalar field in some Kantowski-Sachs' universes, 14:37444 (R;JP)
Natesan, K., Materials tests in support of MHD steam bottoming plant, 14:36357 (BA;US)
Nation, J.A., Novel methods of acceleration. Final report, 30 September 1983-29 September 1988, 14:37067 (R;US)
Nauman, E.B., *See* Belfort, G., 14:35858
Naumov, Yu.Yu., *See* Melkumyants, M.V., 14:36773
Navratil, J.D., Some new developments in actinide solvent extraction systems, 14:36865 (RA;SU)
Ndip, G.M., *See* Walkowiak, W., 14:36834
Neal, C., *See* Hornung, M., 14:37243
Neale, R., *See* Whitehead, P.G., 14:37271
Nebel, R.A., *See* Glasser, A.H., 14:37737
Necker, G., *See* Mader, W., 14:37668
Nedbal, T., Influence of spatial discretization in 3D groundwater flow calculations using the finite-element method, 14:37248 (R;SE)
Neff, W.D., *See* Gudiksen, P.H., 14:37164

Neilsen, M.K., *See* Dreike, P.L., 14:37775
Neilson, M.A., A large-sample extractor for determining organic contaminants in the Great Lakes, 14:37257 (R;CA)
Nekrasov, E.V., *See* Terent'ev, M.V., 14:37659
Nelson, M.E., *See* Berrens, R.P., 14:37399
Nelson, R.W., The need for control agencies to update today's conceptual basis for groundwater quality requirements and subsurface evaluation guidelines, 14:37223 (R;US)
Nelson, T.R., *See* Marland, G., 14:37173
Nesterov, A.F., *See* Anisimov, V.V., 14:36564
Neuffer, D.V., *See* Wang, Tai-Sen, 14:37063
Neugebauer, H.J., Formation and development of deposits in salt strata. Final report, 14:35598 (R;DE;In German)
Neumann, W., *See* Proksch, E., 14:36025
Newberger, B., Application of novel material in crystal accelerator concepts, 14:37049 (R;US)
Newitt, D., *See* Fan, N.Q., 14:36905
Newman, R.C., Evaluation of SCC test methods for Inconel 600 in low-temperature aqueous solutions, 14:36175 (BA;US)
Newport, D.F., *See* Britton, C.L. Jr., 14:37000
Newton, J.O., Measurement and statistical model analysis of prefission neutron multiplicities, 14:37606 (R;AU)
See Hinde, D.J., 14:37607
Newton, M.D., Superexchange coupling mechanisms for electron transfer processes, 14:36735 (R;US)
Newton, S.L., Training management - lessons learned, 14:36056 (RA;US)
Nguyen, D., *See* Singh, S., 14:35707
Nguyen, D.H., *See* Knutson, B.J., 14:36034
Nguyen, N.T., *See* Jones, H.K., 14:36731
Nguyen, T., Molecular dynamics study of high-temperature grain-boundary stability in a (100) $\Sigma = 29$ bicrystal model, 14:37672 (BA;FR)
Nichitiu, F., Molecular picture for dibaryons, 14:37523 (RA;RO;In Romanian)
Semiclassical approach to particle resonances and dibaryons, 14:37522 (RA;RO;In Romanian)
Nickel, H., *See* Roedig, M., 14:36571
Nicklaus, D.M., *See* Davison, B.H., 14:35519
Nicol, T.H., *See* Niemann, R.C., 14:36922
Nicolaou, C.A., Final report of the Commission of Inquiry into Gasoline Pricing in the province of Manitoba, 1987, 14:35655 (R;CA)
Nicolas, A., *See* Hodgdon, M.L., 14:37480
Nicolas, L., *See* Hodgdon, M.L., 14:37480
Nicolson, J.A., Precipitaton, surface and subsurface water chemistry in a tolerant hardwood forest basin, 14:37262 (RA;NO)
Niday, J.B., *See* Gunnink, R., 14:37120
Niegel, A., Hydrogen embrittlement in grain boundaries studied by fatigue crack propagation in Al-Zn-Mg bicrystals, 14:36987 (BA;FR)
Nielsen, H.B., What is special about the group of the standard model?, 14:37528 (R;DK)
Niemann, R.C., Superconducting super collider second generation dipole magnet cryostat design, 14:36922 (J;US)
Niemelae, I., *See* Jaervinen, J., 14:35977
Niessen, H.F., Investigation and test results of the PNP steam reformer test bundle in the EVA-II-plant, 14:36024 (R;DE;In German)
Nigenda, S.E., *See* McMillen, D.F., 14:35521, 14:35531
Nigro, A., *See* Romano, P., 14:36956
Nihoul, G., *See* Faure, J.P., 14:36494
Nikbakht, A., *See* Houlberg, L.M., 14:37220
Nikiforov, A.S., *See* Vashman, A.A., 14:36837
Nikitin, A.V., *See* Arakelian, S.G., 14:37520, 14:37521
Nikitin, V.V., Actual problems and basic tendencies in radiation protection of patients in X-ray diagnosis, 14:37660 (RA;SU;In Russian)
Nikitin, Yu.E., Petroleum sulfides, sulfoxides, and sulfones used as extragents, 14:36839 (RA;SU)
Nikitina, O.M., *See* Zajtsev, S.A., 14:36817
Nikitina, S.D., *See* Baldova, M.V., 14:36786
See Morozov, V.G., 14:36803
Nikolaev, V.M., *See* Bystrov, V.M., 14:37080
Nikolaev, Yu.B., Cracking and rupture of a prestressed reinforced concrete high-pressure vessel, 14:36090 (RA;SU;In Russian)
Niksa, S., *See* Akan-Etuk, Nniefiok, 14:35583
See Lau, Chun Wei, 14:35584
Nilsson, R., *See* Kellner, J., 14:36374
Nimal, J.C., *See* Vergnaud, T., 14:37156
Nimick, F.B., Thermal-conductivity data for tuffs from the unsaturated zone at Yucca Mountain, Nevada: Yucca Mountain Project, 14:35807 (R;US)
Nir, Y., What do we know (and how) about the CKM [Cabibbo-Kobayashi-Maskawa] matrix, 14:37535 (R;US)
Nir, Yosef, Quark mass ratios in semi-leptonic quark decays, 14:37534 (R;US)
Nishikawa, Akira, *See* Matsuura, Kiyokata, 14:37804
Nishino, Nobuhiro, Measurement of the current distribution in JT-60 plasma by He beam, 14:37733 (R;JP;In Japanese)
Niswander, L., Genetics of early embryo survival, 14:37314 (R;US)
Nitzel, M.E., *See* Ware, A.G., 14:36144
Niu Lin, Metallogenetic condition and mineralization characteristics of uranium deposit No.114, 14:35747 (R;CN;In Chinese)
Nixon, M., *See* Bonert, R., 14:36443
No, K., Grain size control in powder processed $Y_1Ba_2Cu_3O_x$, 14:36947 (J;US)
Noble, R.A., Large industry's view of innovative pricing, 14:36319 (RA;US)
Nobrega Coutinho, P. da, Contribution to origin of the reefs in northeastern, 14:37208 (R;BR;In Portuguese)
Nobuo Suzuki, Role of the liquid-liquid partition coefficient of the extractable chelate in the extraction efficiency of metals with β-diketones, 14:36819 (RA;SU)
Nodvin, S.C., Processes affectin the chemistry of waters passing through a high elevator Sierra Nevada watershed, 14:37240 (RA;NO)
Noel, D., Performance of sulfation and nitration plates used to monitor atmospheric pollutant deposition in a real environment, 14:37172 (R;CA)
See Parent, L, 14:36645
Noell, S.K., Incentives for residential direct load control, 14:36307 (RA;US)
Noji, K., Effective simulator training for BWR operating crews in Japan, 14:35986 (RA;US)
Nokhrin, V.I., Solubility diagrams of the systems Li_2SO_4-Na_2SO_4-$MeSO_4$-H_2O (Me-Mg, Mn, Co, Ni, Cu, Zn, Cd) at 25 deg C, 14:36798 (RA;SU;In Russian)
Nolen, J.A., *See* Zeller, A.F., 14:36917
Nolte, D.D., Absolute pressure derivatives of deep level defects in III-V semiconductors, 14:36697 (BA;US)
Nomaguchi, T., *See* Suganami, T., 14:36390
Nordell, B., System design for borehole heat stores, general aspects and operational experience from the store at Lulea, Sweden, 14:36201 (RA;CA;In English and French)
The borehole heat store at Lulea, Sweden, 14:36213 (RA;CA;In English and French)
Norden, H., *See* Lai, Z.H., 14:36511
Nordman, J.E., *See* Martens, J.S., 14:36898, 14:36904
Norman, D.I., *See* Lorenz, J.C., 14:35602
Norman, H., Reinforced confinement in a nuclear reactor, 14:36012 (TG;US)
Norman, M.R., Density functional theory and f electron systems, 14:37693 (BA;US)
Norris, J.O.W., Mechanical degradation of polymer coated glass optical fibres under γ irradiation, 14:37128 (R;GB)
Northby, J.A., Binding energy of large icosahedral and cuboctahedral Lennard-Jones clusters, 14:37697 (J;DE)
Norton, P., *See* Ford, J.K.B., 14:35661
Norton, R.E., Managing instructor training to achieve excellence, 14:36061 (RA;US)
Norton, S.A., Aluminium dynamics in response to experimental additions of acid to a small Norwegian stream, 14:37266 (RA;NO)
Norwood, F.R., *See* Young, E.R., 14:36889
Norwood, K.S., Characterization and chemistry of fission products released from LWR fuel under accident conditions, 14:36184 (BA;US)
Nouet, G., *See* Bary, A., 14:36673
See Vicens, J., 14:36628

November, L.J., Precise proper-motion measurement of solar granulation, 14:37421 (R;US)
Nowicki, T.N., Oxygen segregation in 32°[001] molybdenum tilt grain boundary. I. Segregation sites determination, 14:36502 (BA;FR)
Oxygen segregation in 32°[001] molybdenum tilt grain boundary. II. Enthalpies of segregation determination from AES and grain boundary grooves measurements, 14:36503 (BA;FR)
Noyes, R.P., In search of more output: Two strain gage bridge circuits revisited, 14:37135 (R;US)
Nozdrachev, M.G., *See* Vdovin, S.A., 14:37722
Nykaenen, E., Non renormalization theorem in bosonized n-string formalism, 14:37555 (R;DK)
Nzekwu, B.I., *See* McGee, B.C.W., 14:35711

O

O'Brien, D.M., Preliminary survey report: control technology support for sensor, Unimin Corporation, Dividing Creek Sand Plant, Millville, New Jersey, August 16, 1988, 14:37179 (R;US)
O'Brien, D.W., *See* Thompson, W.M., 14:37153
O'Donnell, G.N., *See* Monaghan, P.F., 14:36214
O'Donovan, N., Guidelines for approved medical officers on health surveillance of radiation workers, 14:37644 (R;IE)
Survey of radioactive waste disposal in Ireland, 14:35788 (R;IE)
O'Hern, T.J., Droplet sizing calibration of the Phase Doppler Particle Analyzer, 14:37145 (R;US)
O'Meara, J., A superconducting toroidal magnet for the CEBAF large acceptance spectrometer, 14:36942 (J;US)
See Brindza, P., 14:36934
O'Neill, D., *See* Balmer, J., 14:37752
O'Neill, E.G., Effects of ozone and simulated acid rain on mycorrhizal infection in two families of Pinus taeda L, 14:37336 (J;US)
O'Neill, H.J., An application of SPANS technology to toxic contaminant monitoring in the Atlantic region, 14:37219 (R;CA)
O'Neill, R., *See* Gardner, R.H., 14:37211
O'Neill, R.V., The role of heterogeneity in structuring spatial hierarchies, 14:37212 (J;US)
O'Rourke, J.C., *See* Haston, J.A., 14:35721
Oberbauer, S.F., *See* Rich, P.M., 14:35918
Obert, J., *See* Le Blanc, F., 14:37592
Oboznyj, V.P., *See* Vdovin, S.A., 14:37722
Obukhova, O.L., Formation of gamma background of building materials with additives of slags and ashes from coal thermal power plants, 14:37647 (RA;SU;In Russian)
Ochkin, A.V., Equilibrium on metal extraction with substituted ammonium salts effect of non-ideality of the organic phase, 14:36861 (RA;SU)
Odomari, Iwao, Trends in research of ion beam application, 14:37683 (RA;JP;In Japanese)
Oehler, W., Behaviour of secondary and trace elements during coal gasification in an iron bath, 14:35534 (R;DE;In German)
Oehrlein, G.S., *See* Marwick, A.D., 14:36695
Oestensson, B., A HVAC system based on seasonal heat storage, 14:36212 (RA;CA;In English and French)
Ogawa, Isamu, Measurement of radiation power from the JIPP T-IIU tokamak plasma, 14:37732 (R;JP)
Ogaza, S., *See* Newton, J.O., 14:37606
Ogle, G.J., *See* Solbes, A., 14:36355
Ogram, G.L., *See* Brown, R.M., 14:37225
Ogura, Waichi., *See* Hosoya, Akio, 14:37445
Oh, K.H., *See* Jeong, I.B., 14:36528
Oh, Y.J., *See* Jung, H.J., 14:36526
Ohene, F., Correlation of stability/rheology relationship with coal properties and chemical additives: Quarterly progress report, September 15, 1988–December 15, 1988, 14:35554 (R;US)
Ohkubo, K., *See* Toi, K., 14:37730
Ohmori, T., *See* Niemann, R.C., 14:36922
Ohnstad, E., Eligibility of noise-abatement proposals for grants-in-aid under the airport improvement program, 14:37398 (R;US)
Ohnuma, S., *See* Goderre, G.P., 14:37050
See Li, Mingyang, 14:37047
See Newberger, B., 14:37049
See Swenson, C.A., 14:37034
Ohtani, T., *See* Menlove, H.O., 14:35757
Ohuchi, F.S., Cu-AlN interface: electronic structure and adhesion, 14:36542 (BA;FR)
Ojima, Shuichi, *See* Kubo, Reijiro, 14:37556
Okamoto, Y., *See* Samuelson, L., 14:36659
Okandan, E., *See* Guemrah, F., 14:35608
Okubo, Tsutomu, *See* Iwamura, Takamichi, 14:36010
Okumura, N., *See* Tatsumi, K., 14:36537
Oland, C.B., *See* Iskander, S.K., 14:36082
Olariu, A., *See* Besliu, C., 14:37519
Oliphant, T.A., *See* Greene, A.E., 14:37003
Oliver, E., *See* Flannery, G., 14:37352
Ollivier, T., *See* Genevey, J., 14:37581
Olsen, D.K., [Twelfth international conference on cyclotrons and their applications, Berlin, W. Germany, and visit to Hahn-Meitner-Institute, May 8–12, 1989]: Foreign trip report, 14:37044 (R;US)
Olson, J., *See* Moore, C., 14:36162
Olson, R., *See* Butler, R., 14:37285
Olson, R.E., *See* McKay, P.F., 14:37776
Olszewski, J., *See* Chruscielewski, W., 14:35597
Omberg, R.P., *See* Knutson, B.J., 14:36034
Omelyan, V.I., *See* Shevchuk, V.G., 14:36779, 14:36781
See Storozhenko, D.A., 14:36782
Oms, J., *See* Le Blanc, F., 14:37592
Onishchenko, I.N., *See* Ivanov, B.I., 14:37059
Onishchenko, M.K., *See* Shevchuk, V.G., 14:36780
Ono, R.H., *See* Gabutti, A., 14:37123
Oona, H., Study of atomic physics and population inversions with plasma focus, 14:37473 (R;US)
See Cochrane, J.C., 14:37686
See Goforth, J.H., 14:37734
See Hodgdon, M.L., 14:37480
Opanasenko, A.N., Stratification of coolant non-isothermal turbulent flows in power plant components, 14:36008 (RA;SU;In Russian)
Opsal, J., *See* Rosencwaig, A., 14:36616
Orlovskij, V.P., *See* Zakharov, N.A., 14:36809
Orr, J.R., *See* Strait, J., 14:36912
Ortiz, M.E., *See* Pouliot, J., 14:37599
Osborne, M.F., *See* Kress, T.S., 14:36110
See Norwood, K.S., 14:36184
Ostashenko, S.V., On geometric simulating in nuclear reactor calculations by the Monte-Carlo method, 14:36077 (RA;SU;In Russian)
Ostic, J., *See* Jacobsen, R.T., 14:35686
Ostrejkovskij, V.A., *See* Kozin, I.O., 14:36107
Ostroushko, V.N., Electromagnetic wave scattering on the jump of the waveguide cross section, 14:37058 (RA;SU;In Russian)
Otaduy, P.J., Supervisory control in a distributed, hierarchical architecture for a multimodular LMR, 14:36094 (R;US)
Otsuki, A., Energy and structure of [100] aluminum grain boundary, 14:36519 (BA;FR)
Ott, K.C., Barium potassium bismuth oxide: Synthesis and physical properties, 14:36639 (R;US)
See Hammel, P.C., 14:36640
See Takigawa, M., 14:36641
Overbeek, R., *See* Butler, R., 14:37285
Overbey, W.K., *See* Wilkins, D.A., 14:35679
Overend, R.P., *See* Chakma, A., 14:35736
Ovsyannikov, D.A., *See* Vladimirova, L.V., 14:37060
Owa, M., *See* Akiya, T., 14:36216
Owen, L., *See* Kelkar, S., 14:35680
Owens, B.B., Investigation of polymeric solid-electrolyte cells, carried out during a nominal three-year period, focused on the rechargeable lithium battery. Final report, 15 July 1985-30 October 1988, 14:36219 (R;US)
Owens, E.C., *See* Likos, W.E., 14:35666
Owens, M.J., *See* Rimpo, J.Y., 14:35669
Oxley, J.H., *See* Tewksbury, T.L., 14:35532

P

Pace, J.G., *See* Robinson, N.A., 14:37328
Pace, J.V. III, *See* Lillie, R.A., 14:36196
Page, J.D., *See* Ware, A.G., 14:36144

Page, M.W., *See* Peters, R.W., 14:37216
Paidar, V., *See* Lejcek, P., 14:36522
Painter, J.A., *See* Klosterbuer, S.F., 14:35756
Painter, S., *See* Knazovich, M., 14:35830
Painter, S.L., Alpha-particle losses in compact torsatron reactors, 14:37715 (R;US)
Transport survey calculations using the spectral collocation method, 14:37714 (R;US)
Paisner, J., *See* Comaskey, B., 14:36969
Pak, Yu.S., *See* Andreev, B.M., 14:36814
Pakko, J.D., *See* McClaine, A.W., 14:36353
See Pian, C.C.P., 14:36354
Pakou, A., *See* Benczer-Koller, N., 14:37590
Pakull, M., *See* Bianchi, L., 14:37435
Pal, R., "Slip effects" in concentrated emulsions, 14:37132 (R;CA)
Palfreyman, J.E., *See* Rottenfuss, B.A., 14:35698
Palibroda, M., *See* Culea, M, 14:37469
Palkovic, J.A., Gabor lens focusing of a negative ion beam, 14:37051 (R;US)
Palmer, A., Quick-response evaluation of energy-related occupational safety and health programs. Task Order 1: mortality study of 50 workers exposed to coal-liquefaction processes at a Union Carbide Plant, Institute, West Virginia, 14:35541 (R;US)
Palmer, B.A., The Los Alamos Fourier-transform spectrometer: Applications to molecular spectroscopy, 14:37138 (R;US)
Palumbo, G., Role of grain boundary structure on the electrochemical stability of passive films formed on high purity polycrystalline nickel, 14:36520 (BA;FR)
Panagia, N., *See* Sanz Fernandez de Cordoba, L., 14:37429
Panchenko, V.I., *See* Borisov, A.D., 14:37039
Panek, R.J., 1981 outburst of the old nova GK persei, 14:37436 (RA;FR)
Panieva, L.A., *See* Akopov, E.K., 14:36787
Pannell, K.D., *See* Toth, L.M., 14:36856
Panov, D.A., *See* Golovin, I.N., 14:37769
See Zhil'tsov, V.A., 14:37765
Panova, N.L., *See* Dergachev, M.B., 14:36556
Panson, A.J., *See* Greeger, R.B., 14:36649
Panter, H.C., Radiation and feeding effects on O_2 uptake in frog tadpoles, 14:37354 (RA;AU)
Pantoflicek, J., *See* Kosek, F., 14:37678
Pao, H.P., *See* Ling, S.C., 14:35577
Papikyan, S.Kh., Enthalpies of melting and polymorphic transformations of alkali metal molybdates, tungstates, and chromates, 14:36761 (RA;SU;In Russian)
Papkovich, V.G., *See* Borovskij, I.V., 14:37061
Paquin, C.E., Effect of temperature on Ty transposition, 14:37295 (RA;US)
Parent, L, Microstructural investigation of $RBa_2Cu_3O_7$-δ (R=Y, Gd, Nd), 14:36645 (R;CA)
Parent, L., *See* Champagne, B., 14:36646
See Ladouceur, M, 14:36643
Paricos, P., *See* Whitehead, P.G., 14:37271
Paris, P., *See* Weiss, B., 14:37589
Paris, P.J., Controlled thermonuclear fusion in TOKAMAK type reactors, the European example: Joint European Torus (JET), 14:37763 (R;BR;In Portuguese)
Park, J.H., *See* King, W.E., 14:36607
Parkash, S., Changes in pore structure of precipitated iron oxide catalysts during pretreatment and hydrocarbon synthesis reaction, 14:36733 (RA;CA)
Parker, J.V., Instability of concave conductor surfaces at high magnetic pressure, 14:37481 (R;US)
Prototype testing for a hybrid gas-gun/railgun device, 14:36878 (R;US)
See Cochrane, J.C., 14:37686
Parker, L.B., *See* Cwalina, G.C., 14:36051
Parker, P., *See* Scott, L., 14:35621
Parker, S., *See* Adolphsen, C., 14:37096
Parkosh, S., The role of acid-base site in the preparation of $A1_20_3$-supported platinum catalysts, 14:36734 (RA;CA)
Parks, V.J., *See* Wood, J.D., 14:36586
Parnovskaya, N.V., *See* Indyk, V.M., 14:37378, 14:37379
Parr, B.F., National Performance Audit Program; ambient air audits of analytical proficiency, 1987, 14:37189 (R;US)
Parr, P.D., Cedar barrens, 14:35920 (J;US)
Parry, J., Instrumentation and control aspects of HIFAR, 14:36120 (RA;AU)
Parsons, I.S., *See* Mikula, R.J., 14:35549
Parsons, N.A., Current HIFAR operations, 14:36122 (RA;AU)
Parsons, P., *See* Brown, J.K., 14:37350
Partridge, R., An Outstanding Junior Investigator Award in experimental high energy physics: Progress report, January 1, 1989 to December 31, 1989, 14:37102 (R;US)
See Cutts, D., 14:37028
Partridge, R.A., *See* Barter, C., 14:37104
Pashchenko, A.B., *See* Bychkov, V.M., 14:37618
Pashen'kov, A.S., *See* Bondarev, B.I., 14:37056
Paskewitz, S.M., *See* McDonald, J.F., 14:37312
Passardi, G., *See* Arnold, R., 14:37101
Passman, S.L., Stress in dilute suspensions, 14:37482 (R;US)
Pastor, C., *See* Drain, D., 14:37116
Patel, V.L., Theoretical modeling of plasma waves in the magnetosphere. Final report, 1 October 1982-30 September 1988, 14:37451 (R;US)
Paterson, K., *See* Brown, D.J.A., 14:37244
Patin, Y., *See* Jahnke, U., 14:37603
Patrilla, V., Personnel development program (an enhancement to GET), 14:36138 (RA;US)
Patterson, L., *See* Hashemi, S., 14:36007
Patton, J.E., *See* Gillman, R.A., 14:36340
Paul, S.K., *See* Kubo, Reijiro, 14:37556
Paulus, W.K., The ASSESS Neutralization Analysis module, 14:35848 (R;US)
Pavlopoulos, T.G., Laser action from syn-(methyl,methyl) bimane, 14:36958 (R;US)
Pavlov, V.I., *See* Simonov, V.D., 14:36009
Payne, J.R., *See* Newberger, B., 14:37049
Payne, M.C., Ab-initio calculation of the microscopic properties of a grain boundary in germanium, 14:36487 (BA;FR)
Payne, M.G., *See* Garrett, W.R., 14:37465
Pearce, B. C., Three-body unitarity, the cloudy bag model, and the Roper resonance, 14:37537 (J;US)
Pearson, B., *See* Goss-Custard, J.D., 14:35945
Pecenov, V.N., *See* Arakelian, S.G., 14:37520, 14:37521
Pechikin, V.A., *See* Simonov, V.D., 14:36009
Pechkovskij, V.V., *See* Malashonok, I.E., 14:36752
Peck, S.D., *See* Luongo, C.A., 14:36916
Peebles, H.C., *See* Jellison, J.L., 14:36583
Peeples, C.R., *See* Dreike, P.L., 14:37775
Pei, Shiyou, *See* Hinks, D.G., 14:36615
Pelipenko, O.A., *See* Zvenigorodskij, A.G., 14:37610
Pelisson, A., *See* Finnegan, D.J., 14:37311
Pelletier, G., Computer software configuration management, 14:36098 (R;CA)
Pellin, M.J., *See* Schauer, M.W., 14:36650
Peloquin, R.A., *See* Kennedy, W.E., Jr., 14:35785
Pelton, A.R., *See* Trybus, C.L., 14:36599
Pemberton, S.G., *See* Keith, D.A.W, 14:35694
See Mattison, B.W., 14:35695
See Ranger, M.J., 14:35697
Peng, T.H., Thirteenth radioactive conference, radiocarbon measurements and applications, Dubrovnik, Yugoslavia, June 20–25, 1988: Foreign trip report, 14:37406 (R;US)
Penin, N.A., *See* Aslanov, G.A., 14:37726
Penisson, J.M., Atomic structure of tilt boundaries in Mo bicrystals, 14:36486 (BA;FR)
See Nowicki, T.N., 14:36502
Pennell, W.E., Mission survey for the Pressure Vessel Research User's Facility (PVRUF), 14:36011 (R;US)
See Cheverton, R.D., 14:36006
Peoples, J., Status of the SSC superconducting magnet program, 14:36910 (J;US)
Peplov, V.V., *See* Amosov, I.I., 14:37081
Peppas, N.A., Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, January 15, 1989–April 15, 1989, 14:35553 (R;US)

Pepper, J.M., Study of the conversion of lignocellulosic (aspen) materials to liquid fuels and chemicals, 14:35862 (R;CA)
Peraino, C., *See* Weinstein, I.B., 14:37389
Perelyaeva, L.A., *See* Kristallov, L.V., 14:36775
Perepelitsa, A.P., *See* Klevtsov, P.V., 14:36758
Perez, P., *See* Galiasso, R., 14:35704
Peries, J.P., ASVAHL new routes for prosessing heavy oils, 14:35636 (RA;CA)
Perison, J., *See* Eser, Semih, 14:35643
Perkins, E., Hydrogeological and geochemical criteria for assessing sites of subsurface injection of EOR waste water in the Cold Lake area, Alberta, Canada, 14:35739 (RA;CA)
Perkins, K., *See* Ludewig, H., 14:36128
Perl, M.L., The search for charged-lepton specific forces and the PEGASYS facility, 14:37531 (R;US)
Perminov, A.A., *See* Simonov, V.D., 14:36009
Perrin, N., *See* Bourgeois, C., 14:37591, 14:37593
Perry, A.M., *See* Fulkerson, W., 14:36245
Perry, M.B., Structural definition of synthetic fuels, Wilsonville I, 14:35560 (R;US)
Persad, C., Consolidation of powders of the oxide superconductor YBa_2Cu_3Ox by high energy-high rate processing, 14:36611 (R;US)
Pershin, V.I., Choice of the cathode for the injector of the LIU-5/5000 linear induction accelerator, 14:37079 (RA;SU;In Russian)
Persiani, P.J., Implementation of isotope correlation technique for safeguards, 14:35836 (R;US)
Perucca, J.C., Geological and geophysical investigations at Sierra del Medio massif - Argentine, 14:37403 (R;AR)
Peshkov, A.V., *See* Zhavoronkova, K.N., 14:36813
Pesic, B., Electrochemistry of thiobacillus ferrooxidans reactions with pyrite: Technical progress report, January 15–April 15, 1989, 14:35528 (R;US)
Peters, C., *See* Pope, W.L., 14:36923
Peters, R.W., Containment of organic leachates from leaking underground storage tanks using tailored soils as liners, 14:37216 (R;US)
Peterson, D., *See* Greeger, R.B., 14:36649
Peterson, D.L., *See* Bowers, R.L., 14:37012
See Greene, A.E., 14:37003
Peterson, D.R., *See* Persad, C., 14:36611
Peterson, E.J., *See* Ott, K.C., 14:36639
Peterson, L.W., Development and implementation of quality based team and diagnostic skills training at the advanced test reactor, 14:36112 (RA;US)
Petit, J., Process and preparation facility for uranium tetrafluoride, 14:35760 (TG;US)
Process and preparation facility for double uranium fluoride, 14:35761 (TG;US)
Petrenko, S.V., *See* Il'in, V.I., 14:37077
Petricevic, V., Laser action in chromium-activated forsterite for near-infrared excitation, 14:36959 (R;US)
Petrov, A.A., *See* Zusman, L.L., 14:36552
Petrovic, J.J., *See* Carter, D.H., 14:36638
Petrukhin, O.M., *See* Varnek, A.A., 14:36818
Petty, S.W., *See* McClaine, A.W., 14:36353
See Pian, C.C.P., 14:36351, 14:36354
See Solbes, A., 14:36355
Petushkova, N.A., *See* Glushkov, E.S., 14:36078
Pfaffelhuber, M., *See* Roedig, M., 14:36571
Pfluger, N., *See* Butler, R., 14:37285
Phifer, M.S., *See* Johnson, M.L., 14:37820
Philippacopoulos, A.J., Recommendations for resolution of public comments on USI [Unresolved Safety Issues] A-40, "Seismic Design Criteria", 14:36165 (R;US)
Phillips, J.E., *See* Birkmire, R.W., 14:35911, 14:35913
Phillips, J.T. Jr., *See* Clinard, J.A., 14:37819
Philpot, S.R., Grain boundaries in silicon from zero temperature through melting, 14:36476 (R;US)
Phinney, N., *See* Haiessinski, J., 14:37066
Pi, M., *See* Suraud, E., 14:37608, 14:37762
Pian, C.C.P., Experimental investigation of factors affecting the cathode wall slag layer resegmentation frequency, 14:36351 (BA;US)
Voltage-current characteristics of the insulator gaps in a slagging MHD generator, 14:36354 (BA;US)
See McClaine, A.W., 14:36353
See Solbes, A., 14:36355
Piccioni, A., *See* Giovannelli, F., 14:37434
Pich, J., Corrosion aggressiveness og groundwaters on the underground route in Warsaw, 14:37269 (RA;NO)
Pih, H., *See* Liu, K.C., 14:36617
Pilat, J.F., Challenges to the nonproliferation regime into the 21st Century: Conference summary, 14:36454 (R;US)
Pilli, A., *See* Anderson, E., 14:37275
Pina, R., *See* Marott, A., 14:35606
Pinard, J., *See* Le Blanc, F., 14:37592
Pinder, J.E. III, Plant photosynthetic pathways and grazing by phytophagous orthopterans, 14:35919 (J;US)
Pines, A., *See* Fan, N.Q., 14:36905
Pinet-Berger, M.H., *See* Laval, J.Y., 14:36672
Pinhasik, D.S., *See* Spilrain, E.E., 14:35605
Pinho Guimaraes, I. de., *See* Silva Filho, A.F. da, 14:36709
Pique, A., *See* Benczer-Koller, N., 14:37590
Pirogov, Yu.F., *See* Alekhin, S.I., 14:37518
Pirouz, P., Hexagonal silicon, 14:36691 (BA;US)
Pisent, A., *See* Wang, Tai-Sen, 14:37063
Pitcher, E., *See* Sherman, J., 14:37089
Pitner, A.L., FFTF metal fuel pin sodium bond quality verification, 14:36036 (R;US)
Placidi, M., *See* Haiessinski, J., 14:37066
Plagnol, E., *See* Pouliot, J., 14:37599
Plasil, F., Attained energy densities and neutral pion spectra in nucleus-nucleus collisions at 200 GeV/nucleon, 14:37597 (R;US)
Plyaskin, V.I., *See* Bychkov, V.M., 14:37618
See Grudzevich, O.T., 14:37612
Poco, J.F., *See* Angel, S.M., 14:36848
Poggio, A.J., Energy and Technology Review, 14:37303 (R;US)
Pogorel'skaya, S.A., *See* Danilov, N.A., 14:36842
Pokrasin, M.A., *See* Mozgovoj, A.G., 14:36553
Poletaev, I.F., *See* Arkhipov, S.M., 14:36806
Policastro, P.F., *See* Wilson, M.C., 14:37292
Polishchuk, S.A., *See* Mel'nichenko, E.I., 14:36783
Politova, E.D., *See* Proskuryakova, E.V., 14:36759
Politzer, I.R., *See* Paviopoulos, T.G., 14:36958
Pollina, R.J., *See* Rosa, R.J., 14:36352
Pollock, C.R., *See* Gosnell, T.R., 14:36957
Poloskov, S.I., Optimization of technological parameters of welding process by stabilized arc of reverse polarity, 14:36562 (RA;SU;In Russian)
See Belousov, A.N., 14:36566
Poloznikova, M.Eh., Connection between structure of alkali metal molybdates and tungstates and their spectral and energetic characteristics, 14:36763 (RA;SU;In Russian)
Polunin, G.V., Non-standard means of mechanization for auxiliary and repair operations, 14:36873 (RA;SU;In Russian)
Pomphrey, N., *See* Stotler, D.P., 14:37739
Ponikarova, T.M., ^{210}Po incorporation to the structure of sulfurcontaining aminoacids, 14:37364 (RA;SU;In Russian)
Ponomareva, T.V., Formation and prevention of destructive changes in mucous membranes of stomach of irradiated rats, 14:37360 (RA;SU;In Russian)
Pontikis, V., Grain boundary structure and phase transformations: a critical review of computer simulation studies and comparison with experiments, 14:37670 (BA;FR)
Popa, L., *See* Besliu, C., 14:37519
Popa, V., *See* Besliu, C., 14:37519
Pope, C.N., *See* Bergshoeff, E., 14:37700
Pope, L.E., *See* Barton, B.D., 14:37688
See Cross, J.B., 14:36844
Pope, R.B., Radioactive materials packaging standards and regulations: Making sense of it all, 14:35778 (R;US)
Pope, W.L., An alternate method for designing dipole magnet ends, 14:36923 (J;US)
Popeko, G.S., *See* Szaro, S., 14:37115
Poplavskij, K.K., Theory and practice of sanitary inspection of radiological units, 14:37650 (RA;SU;In Russian)
Popov, D.K., *See* Basalaeva, L.N., 14:37356

Popov, S.O., *See* Bagreev, V.V., 14:36716
Popov, Yu.P., *See* Boneva, S.T., 14:37633
Popova, N.Ya., *See* Pershin, V.I., 14:37079
Popova, R.A., *See* Baldova, M.V., 14:36786
Porodzinskij, Yu.V., *See* Klepatskij, A.B., 14:37625
Porquet, M.G., *See* Bourgeois, C., 14:37591, 14:37593, 14:37627
See Kilcher, P., 14:37594
Portfors, E., Build-operate-transfer concept. A case history from Turkey, 14:35870 (RA;CA)
Portier, R., *See* Tremouilles, G., 14:36629
Portnov, O.G., *See* Zakharov, N.A., 14:36809
Portnova, S.M., *See* Akhmatova, Zh.T., 14:36778
Poskanzer, A.M., *See* Gutbrod, H.H., 14:37110
Post, D., *See* Wood, J.D., 14:36586
Postma, A.K., *See* Hilliard, R.K., 14:36028
See McCormack, J.D., 14:36029
Postnikov, N.S., Dynamics of a reactor with discrete control system under restriction on the control action value, 14:36099 (RA;SU;In Russian)
See Migalov, I.V., 14:36100
Potemkin, V.F., Neutron diffraction study of crystal structure of Ge_4Na, Ge_4K, Ge_4Rb, and Ge_4Cs, 14:36548 (RA;SU;In Russian)
See Zusman, L.L., 14:36552
Pottelette, R., *See* Marklund, G.T., 14:37447
Potterveld, D., *See* Young, L., 14:37572
Poucet, A., *See* Contini, S., 14:35980
Poukey, J.W., *See* Sanford, T.W.L., 14:37092
Pouliot, J., Excitation and multiple dissociation of projectiles at intermediate energy, 14:37599 (R;US)
Pounds, L.R., *See* Parr, P.D., 14:35920
Pourang, R., *See* Watson, J. W., 14:37579
Pourprix, M., Air purification techniques for radon daughters in uranium mines, 14:35835 (RA;CA;In French)
Pourrahimi, S., Intermediate scale industrially processed Nb_3Sn(Ti) by powder metallurgy, 14:36941 (J;US)
Povard, V., *See* Appel, B.R., 14:37188
Powell, H.T., *See* Murray, J.E., 14:37782
Powell, J.R., *See* Ludewig, H., 14:36128
Pranal, Y., *See* Jahnke, U., 14:37603
Prassinos, P.G., Seismic margin screening insights for light water reactors, 14:36170 (BA;DE)
Predazzi, E., *See* Bediaga, I., 14:37516
Predel, B., *See* Fournelle, R.A., 14:36523
Pregenzer, A.L., Electrohydrodynamically driven, large-area liquid metal ion source for inertial confinement fusion, 14:37778 (R;US)
See McKay, P.F., 14:37776
See Stinnett, R.W., 14:37780
Prestwich, K.R., *See* Warren, F.T., 14:36882
Price, C., Lessons from gas privatisation, 14:36273 (RA;GB)
See Littlechild, S., 14:36271
Price, D.L., *See* Saboungi, M.L., 14:36662
Price, M., *See* Butler, R., 14:37285
Price, R., Siting the superconducting super collider, 14:37033 (R;US)
Priddy, T.G., Strain to failure of pressurized thick wall cylinders, 14:36995 (R;US)
Priester, L., *See* Bouchet, D., 14:36504
See Khalfallah, O., 14:36507
See Lartigue, S., 14:36632
Pritchett, L.C., *See* Simons, C.A., 14:35865
Prokhorova, L.V., *See* Butylkin, B.B., 14:36565
Prokof'ev, O.N., Experimental data on weakening gamma-radiation by boring well, 14:37648 (RA;SU;In Russian)
Prokosch, M.W., *See* Hansen, H.J., 14:36587
Proksch, E., HTR research and development in Austria. 1987/1988 progress report, 14:36025 (R;AT)
Pronin, A.A., Recharging container, 14:36875 (RA;SU;In Russian)
Pronin, I.S., *See* Vashman, A.A., 14:36837
Pronzhenko, N.M., *See* Borisov, A.D., 14:37039
Proskuryakova, E.V., Double chromates of rubidium, cesium and rare earth elements, 14:36759 (RA;SU;In Russian)
Prosser, G.A., Marketing for Oak Ridge technology transfer, 14:36242 (R;US)
See Soderstrom, E.J., 14:36246
Protopopescu, V., *See* Culioli, J.C., 14:37799
Proulx, R., *See* Desrochers, G., 14:35971
Proyayev, V.V., *See* Sedov, V.M., 14:36717
Prozesky, V.M., Lifetime of the O_2^+ state of ^{72}Ge, 14:37584 (RA;ZA;In Afrikaans)
Puehlhofer, F., *See* Heusch, B., 14:37587
Puffenberger, S.F., *See* Hajek, B.K., 14:35755
Pugh, C.E., *See* Pennell, W.E., 14:36011
Puglia, G.P., *See* Samuelson, L., 14:36659
Puigdomenech, H.H., *See* Perucca, J.C., 14:37403
Pul'kov, V.N., Effect of Sr^{90} and ethanol on work ability in case of combined and separate action of these factors, 14:37373 (RA;SU;In Russian)
Pulkkinen, U., *See* Jaervinen, J., 14:35977
Purohit, M. V., Charm physics, 14:37515 (J;US)
Purvis, E.E., Chernobyl-4 accident analysis, 14:36183 (BA;DE)
Puseljic, D., *See* Ruchti, R., 14:37109
Putaux, J.C., *See* Le Blanc, F., 14:37592
Putney, J.M., Proposals for improving interphase drag modelling for the bubbly and slug regimes in RELAP5, 14:36001 (R;GB)
Puttock, J.S., *See* Witlox, H.W.M., 14:37178
Pyartman, A.K., *See* Kopyrin, A.A., 14:36800

Q

Qi, J., Comparative economic analysis of heavy oil recovery projects in China and Canada, 14:35645 (RA;CA)
Quinby-Hunt, M.S., Effects of structure on scattering from marine organisms, 14:37250 (BA;US)
Quinlan, N., Evaluating learning strategies in operator training programs, 14:36062 (RA;US)

R

Rabin, A.A., Hydrogen isotopes effect on efficiency of helium cryosorption pumping out by argon condensed layers, 14:36877 (RA;SU;In Russian)
See Zhil'tsov, V.A., 14:37765
Rabut, P., Institutional aspects of DSM in France, 14:36327 (RA;US)
Rachko, Z.A., *See* Valbis, Ya.A., 14:37680
Radack, D., *See* Booske, J.H., 14:36961
Rader, D.J., *See* O'Hern, T.J., 14:37145
Radhakrishnan, B., *See* Thompson, R.G., 14:36513
Ragozin, E.N., Ionization of Rydberg energy levels of ions at low temperature, 14:37470 (RA;SU;In Russian)
Rahl, T.E., *See* Ware, A.G., 14:36144
Rahman, A.K.M., *See* Samuelson, L., 14:36659
Rahn, F.J., *See* Muhlestein, L.D., 14:36187
Raistrick, I.D., Transition metal oxide electrochemical capacitors, 14:37021 (BA;US)
Rajagopalan, S., Applications of a plasma lens with bootstrap disruption, 14:37065 (R;US)
Rajani, B., Regional characterization of geomechanical properties of unconsolidated sands of the heavy oil belt, Venezuela, 14:35734 (RA;CA)
Rakar, G., *See* Spilrain, E.E., 14:35605
Rako-Andriantsilavo, M.D, *See* Ratsimandresy, R., 14:35737
Rakov, Eh.G., *See* Melkumyants, M.V., 14:36773
Raman, V., Cyclic migration and fracture in solid solution alloys, 14:36988 (BA;FR)
Ramanathan, M., *See* Montano, P.A., 14:37477
Ramasamy, S., *See* Siegel, R.W., 14:36534
Rambaek, J.P., *See* Lydersen, E., 14:37263
Ramesh, R., *See* Green, S.M., 14:36953
Ramirez E., O., *See* Thayer, G.R., 14:35595
Ramirez, A., *See* Thayer, G.R., 14:35595
Ramrus, A., *See* Freeman, B.L., 14:37009
Ramsaran, A., The effects of well completion, steam injection and production practices on heavy oil production performance, 14:35613 (RA;CA)
Ramzaev, P.V., Main trends of radiation hygiene development in 9 Five-Jear Plan, 14:37646 (RA;SU;In Russian)
Randarevich, S.V., *See* Varnek, A.A., 14:36818

Ranger, M.J., A quantitative approach to the geological evaluation of the tar sands of south Athabasca, Alberta, 14:35697 (RA;CA)
Rao, A.M., *See* Hoffman, D.M., 14:36696
Rao, G.N., *See* Jyothi, A., 14:36835
Raparia, D., Compact linacs for positron emission tomography, 14:37035 (R;US)
See Tompkins, P.A., 14:37073
Raposo, C., *See* Paris, P.J., 14:37763
Rasmussen, D.A., *See* Langley, R.A., 14:37758
Ratsimandresy, R., Positive effects of the bemolanga tar sands exploitation, 14:35737 (RA;CA)
Raveloson, E., *See* Ratsimandresy, R., 14:35737
Ravinovici, I.M., *See* Arakelian, S.G., 14:37520, 14:37521
Ravnik, M., Calculation analysis of TRIGA MARK II reactor core composed of two types of fuel elements. Final report for the period 1 August 1984 - 31 July 1986, 14:36115 (R;XA)
Rawl, R.R., *See* Pope, R.B., 14:35778
Ray, E.R., Solid-oxide fuel-cell technology development. Annual report, May 1, 1987-April 30, 1988, 14:36365 (R;US)
Ray, S.S., *See* McKee, J.E., 14:35963
Rayburn, T.F., *See* Langley, R.A., 14:37758
Raymond, J.C., IUE observations of oxygen-rich supernova remnants, 14:37430 (RA;FR)
See Panek, R.J., 14:37436
Raymond, R., *See* Bedard, N., 14:35970
Raymond, T.D., Pulse-train amplification of subnanosecond near-transform-limited KrF laser pulses, 14:36972 (BA;US)
Razbin, V.V., Tube wastage in FBC boilers at Summerside - causes and resolution, 14:35587 (R;CA)
Tube wastage in FBC boilers at Summerside - causes and resolution, 14:37022 (R;CA)
Read, P.M., A lithium liquid metal ion source suitable for high voltage terminal applications, 14:37466 (R;US)
Rebas, E., *See* Pich, J., 14:37269
Rebmeister, R., *See* Haas, F., 14:37071
Recupero, V., *See* Restuccia, G., 14:36211
Reddoch, T.W., Technological requirements for new pricing strategies, 14:36298 (RA;US)
Reddy, J.F., *See* Merkle, K.L., 14:36627
Redford, D., *See* Toma, P., 14:35715
Reed, R.P., The PVF2 piezoelectric polymer shock stress sensor: System characterization for application under field test conditions, 14:36891 (R;US)
Reffo, G., On the two gas approach for exciton model master equation, 14:37611 (RA;XA)
See Blann, M., 14:37616
Rego, R.A., *See* Nair, R.P.K., 14:37801
Rehm, W., *See* Bongartz, R., 14:36157
Rehmat, A., *See* Goyal, A., 14:35544
Reich, M., Development of alternate visual examination requirements for dynamic restraints (snubbers), 14:36129 (R;US)
Reichman, J., TV interference study on distribution test line, 14:35974 (R;CA)
Reid, D., Information processing at N.B. Power, 14:37824 (RA;CA)
Reijers, H.T.J., *See* Saboungi, M.L., 14:36662
Reilly, H.J., PRISIM - a plant risk status information management system for NRC inspectors, 14:36182 (BA;DE)
Reim, K., Radon emanation at the Mullenbach research uranium mine and its effects on ventilation planning, 14:35752 (RA;CA)
Reimann, J., Gas-liquid flow in dividing Tee-junctions with a horizontal inlet and different branch orientations and diameters, 14:36981 (R;DE)
Reinhardt, G.C., Vulnerability inducing technologies: An initial appreciation, 14:36455 (R;US)
Reinholt, D.R., *See* Watson, J.S., 14:36706
Reinisch, B.W., Electron-density profiles and plasma-drift measurements with digital ionosondes. Technical report, July 1987-June 1988, 14:37452 (R;US)
Reinovsky, R.E., High voltage power condition systems powered by flux compression generators, 14:37005 (R;US)
High-performance, high-current fuses for flux compression generator driven inductive store power conditioning applications, 14:37013 (R;US)
See Goforth, J.H., 14:37734
See Lindemuth, I.R., 14:37006
Reiser, C., *See* Raymond, T.D., 14:36972
Reisfeld, R., Transparent glass ceramics doped by chromium(iii) and chromium(iii) and neodymium(iii) as new materials for lasers and luminescent solar concentrators. Final report, 1 October 1985-30 June 1988, 14:35928 (R;IL)
Reister, D.B., *See* Fulkerson, W., 14:36245
Reitman, V., *See* Toma, P., 14:35715
Rej, D.J., Performance of the 10kV, 100-kA pulsed-power modules for the FRX-C magnetic compression experiment, 14:37771 (R;US)
Rek, Z.U., *See* Hahn, S., 14:36694
Remaud, B., *See* Rivet, M.F., 14:37472
See Suraud, E., 14:37608, 14:37762
Remillard, R., *See* Shrader, C.R., 14:37433
Remington, B.A., *See* Fields, D.J., 14:37600
Renard, D., *See* Faure, J.P., 14:36494
Renard, G., *See* Combe, J., 14:35611
Renard, P., *See* Peries, J.P., 14:35636
Renis, T., *See* Jordan, S.E., 14:35847
Renk, R.R, Electrocoagulation of tar sand tailings pond waters, 14:35740 (RA;CA)
Requa, J., Cray-to-sun prototype, 14:37814 (R;US)
Restuccia, G., Energy storage by adsorption of water on zeolite for building heating, 14:36211 (RA;CA;In English and French)
Reucroft, P.J., Structural and surface characterization of dispersed metal catalysts: Final report, September 1, 1986–December 31, 1988, 14:36482 (R;US)
Reunova, L.N., *See* Krutyakov, A.N., 14:36636
Reviu, E., *See* Chiosila, I., 14:37346
Reynen, M., Construction of an expression vector for the gram-negative bacterium Zymomonas mobilis, 14:37315 (R;DE;In German)
Reynolds, B., *See* Hornung, M., 14:37243
Reznik, A.M., *See* Alekperov, E.R., 14:36836
See Apanasenko, V.V., 14:36822
Rhen, I., *See* Wilen, P., 14:36207
Rhoades, W.A., Radiation exposure inside reinforced concrete buildings at Nagasaki, 14:37381 (R;US)
Rhodes, C.K., Studies of collisional and nonlinear radiative processes for development of coherent uv and xuv sources. Final report, 30 September 1985-29 September 1988, 14:37463 (R;US)
Rhodes, E., *See* Pal, R., 14:37132
Rial, J.A., Modeling of subsurface geology in Medicine Lake, California, 14:35939 (R;US)
Ribeiro de Azambuja, A., Estreito field study of reservoir for the extension of steam cyclic injection pilot projects, 14:35614 (RA;CA)
Rice, D.E., *See* Knapp, F.F. Jr., 14:37320
Rich, P.M., Canopy photography for assessment of local light environment of tropical forest trees and palms, 14:35918 (J;US)
Richards, C.N., *See* Spulak, R.G. Jr., 14:36195
See Turman, B.N., 14:37773
Richards, D.R., *See* Hinks, D.G., 14:36615
Richards, E.A., *See* Scott, J.D., 14:35628
Richards, P.M., *See* Myers, S.M., 14:36606
Richardson, A.K., *See* Haggag, F.M., 14:36172
Richmond, G.L., Measurements of the structure and dynamics of thin film growth on electrode surfaces by SHG, 14:36369 (BA;US)
Richthofen, A. von., Mass spectrometry for investigations into the system lead/oxygen, using the electrochemical Knudsen cell, 14:36743 (R;DE;In German)
Rickel, D.G., A simultaneous helical generator, 14:37011 (R;US)
See Freeman, B.L., 14:37009, 14:37090
See Oona, H., 14:37473
Riddiford, A.W., *See* Harding, D.J., 14:37074
Riddle, R.A., The failure of aluminum compact shear specimens under mixed-mode loading, 14:36597 (BA;US)
Riedel, H., Recent advances in modelling creep crack growth. Proceedings, 14:36545 (R;DE)
Riegel, B., *See* Wolfert, K., 14:36151
Riester, L., *See* Stinton, D.P., 14:35961
Riggs, C., *See* O'Meara, J., 14:36942
Riles, K., Review of "close-mass" heavy lepton searches, 14:37514 (R;US)

Riley, D.J., On the limitation of the weak-coupling assumption for crosstalk analysis in an inhomogeneous medium, 14:35975 (R;US)
Rimpo, J.Y., Technology 'Master List' data base management system. User's manual. Topical report, 14:35669 (R;US)
Rinchik, E.M., *See* Niswander, L., 14:37314
Rinejskij, A.A., *See* Sataev, E.A., 14:36073
See Sinitsa, V.V., 14:37626
Ringler, C.E., Advanced Small Site Program, 14:37789 (R;US)
Ripmeester, J.A., *See* Kotlyar, L.S., 14:35733
Rispin, W.E., *See* Goss-Custard, J.D., 14:35945
Ritchie, R.O., A comparison of fatigue crack propagation in Modes I and III, 14:36701 (BA;US)
Ritter, H.G., *See* Gutbrod, H.H., 14:37110
Ritz, K.N., *See* Hahn, S., 14:36694
Rivas, O., *See* Ziritt, J.L., 14:35607
Rivera, R.O., Health-hazard evaluation determination report No. 75-109, 110, 112, 114-274, Fairbanks Weighing Division, Colt Industries, St. Johnsbury, Vermont, 14:37182 (R;US)
Rivet, M.F., Dynamical aspects of violent collisions in Ar + Ag reactions at E/A = 27 MeV, 14:37472 (R;FR)
Fusion-fission of heavy systems: influence of the entrance channel mass asymmetry, 14:37578 (R;FR)
Rivier, N., The topological structure of grain boundaries, 14:36477 (R;US)
Roach, D.P., *See* Priddy, T.G., 14:36995
Roberge, H., *See* Noel, D., 14:37172
Roberge, R., *See* Newman, R.C., 14:36175
Robert Blake II, Respiratory enzymes of Thiobacillus ferrooxidans: Progress report, March 1988–July 1989, 14:37325 (R;US)
Roberti, G., *See* Gomez, M.T., 14:37422
Roberts, D., Role of the bacterial host in the mechanism and regulation of Tn10 transposition, 14:37304 (RA;US)
Roberts, R., Electrode-induced beta battery degradation. Final report, 14:36222 (R;US)
Robertson, A., *See* Addison, J., 14:37190
Robertson, E., *See* Balmer, J., 14:37752
Robertson, I.M., Dynamic studies of deformation and fracture at grain boundaries, 14:36533 (BA;FR)
Robertson, J.B., *See* Huyakorn, P.S., 14:35793
Robertson, R.C., *See* Devgun, J.S., 14:37226
Robertson, R.G.H., Neutrino mass experiments, 14:37511 (R;US)
Robins, K.E., *See* Ghosh, A.K., 14:36933
Robinson, B.A., A discrete fracture model for a hot dry rock geothermal reservoir, 14:35941 (R;US)
Robinson, C., Why British coal should be privatised, 14:36272 (RA;GB)
See Littlechild, S., 14:36271
Robinson, G.C., *See* Cheverton, R.D., 14:36006
See Iskander, S.K., 14:36082
Robinson, J.J., *See* Clinard, J.A., 14:37819
Robinson, M.R., *See* Ward, K.J., 14:37300
Robinson, N.A., Characterization of chemically tritiated microcystin-Lr and its distribution in mouse. Interim report, 14:37328 (R;US)
Robinson, R.L. Jr., Phase equilibrium data for development of correlations for coal fluids: Report for the period April 15, 1989–June 15, 1989, 14:35530 (R;US)
Robinson, R.N., *See* Ruiz, C.P., 14:35991
Robinson, S.M., Impacts of DOE Order 5820.2A on Oak Ridge National Laboratory, 14:37227 (R;US)
Robinson, T., *See* MacInnes, C., 14:36400
Robotham, F.P.J., Review of radiation safety at a gamma sterilization plant, 14:37642 (RA;AU)
Rochau, G.E., Performance of plasma opening switches for the Particle Beam Fusion Accelerator II (PBFA II), 14:37774 (R;US)
See Moore, W.B., 14:37016
Rockwell, N.C., Managing training to maximize employee articulation, 14:35829 (RA;US)
Roden, M.E., *See* Hendriksz, P.J., 14:35998
Roderick, N.F., Two-dimensional effects in hollow core Z-pinches, 14:37743 (R;US)
Two-dimensional effects in imploding plasma liners, 14:37742 (R;US)
Rodgers, J., *See* Booske, J.H., 14:36961
Rodrigues, L.M.C.S., Black-hole decay and topological stability in quantum gravity, 14:37426 (R;BR)
Roedig, M., Fracture mechanics investigations for components of the steam cycle in an HTR electricity producing plant, 14:36571 (R;DE;In German)
Roegner-Maniscalco, V., *See* Witkin, E.M., 14:37340
Roehrig, J.R., *See* Acton, D.S., 14:37423
Roeske, S.B., *See* Evans, E.P., 14:37002
Roetzer, H., Automatic programmable air sampling stations. Instruction manual, 14:37118 (R;AT;In German)
Rogers, G.O., *See* Adler, V., 14:37344
Rogers, V.C., Below Regulatory Concern Owners Group: Assessment of the IMPACTS-BRC code: Final report, 14:35786 (R;US)
Rohr, D.C., *See* Zocco, T.G., 14:36598
Rokkan, D.J., Westinghouse Hanford Company 100 Areas environmental releases for 1987, 14:35812 (R;US)
Rolfe, S.T., *See* Wellman, G.W., 14:36602
Rolland, A., *See* Charai, A., 14:36506
Rollett, A.D., Polycrystal plasticity as applied to the problem of in-plane anisotropy in rolled cubic metals, 14:36572 (R;US)
Roman, C.P., Three alternative simulation systems for training nuclear power plant personnel, 14:36040 (RA;US)
Romano, P., A simple method for preparing superconducting high Tc thin films, 14:36956 (J;US)
Romero, O., Steam stimulation experience in Lake Maracaibo, 14:35616 (RA;CA)
Rong-Fang Xi, *See* Chun-Hui Huang, 14:36826
Ronne, H., *See* Rothstein, R.J., 14:37293
Rooney, R.C., *See* Price, R., 14:37033
Roop, J.M., *See* Serot, D.E., 14:35654
Rorrer, G.L., Glucose yields from the solvolysis of wood and pure cellulose by anhydrous Hydrogen Fluoride vapor, 14:35869 (BA;US)
Rosa, R.J., On the nature of slag chemistry in an MHD generator, 14:36352 (BA;US)
Rose, A., *See* Buehler, H., 14:36581
Rose, D.E., In defense of the Clark hot water process, 14:35719 (RA;CA)
Rose, E.A., *See* Kang, M., 14:36963
Rose, H.A., *See* DuBois, D., 14:37457
Rose, R.J., *See* Goss-Custard, J.D., 14:35945
Rose-Hansen, J., *See* Fabricius, J., 14:37416
Rosenberg, M., Business guide to energy performance contracting. Final report, 14:36392 (R;US)
Rosencwaig, A., Thermal conductivity anisotropy in single crystal $YBa_2Cu_3O_{7-x}$, 14:36616 (R;US)
Rosenqvist, J.T., Acidity of surface water in Norway, 14:37242 (RA;NO)
Rosenthal, P., Low frequency resistance fluctuations in films of high temperature superconductors, 14:36900 (J;US)
See Missert, N., 14:36955
Rosenthal, P.A., *See* Ferrari, M.J., 14:36897
Rosenzweig, J., *See* Rajagopalan, S., 14:37065
Roshchin, V.V., *See* Zakharov, Yu.V., 14:36567
Roshchupkin, V.V., *See* Mozgovoj, A.G., 14:36553
Rosing, M., The measurement of Twiss parameters using SFC's, 14:37070 (R;US)
Ross, D.S., *See* Hirschon, A.S., 14:35527
Ross, G.G., *See* Greene, B.R., 14:37529
Ross, P.N., *See* Kortright, J.B., 14:36854
Ross, W.A., Treatment needs for Greater-Than-Class C low-level waste, 14:35804 (R;US)
Rossarie, J., *See* Peries, J.P., 14:35636
Rosu, C.H., Investigation of relativistic heavy ion interactions with the atomic nuclei, 14:37623 (R;RO;In Romanian)
Rote, D.M., The US market for high-speed maglev vehicles, 14:36401 (R;US)
Roth, E., Prospects of ceramic tritium breeder materials, 14:37754 (R;FR)
Rothenburg, L., *See* Dusseault, M.B., 14:35735
Rothstein, R.J., Genetic control of recombination between repeated sequences, 14:37293 (RA;US)
Rottenfuss, B.A., Geology of the AOSTRA underground test facility site, 14:35698 (RA;CA)

Rottman, C., Theory of phase transitions at internal interfaces, 14:37669 (BA;FR)
Roudeau, P., Charm photoproduction mechanisms and a few preliminary results from the NA 14' experiment, 14:37554 (R;FR)
Roush, K.M., Adult learning techniques in maintenance training, 14:35988 (RA;US)
Rousseau, J., *See* Couture, R., 14:36398
Roussiere, B., *See* Bourgeois, C., 14:37627
See Kilcher, P., 14:37594
Routbort, J.L., *See* King, W.E., 14:36607
Roux, D., *See* Charai, A., 14:36506
Roux, N., *See* Roth, E., 14:37754
Rovere, L.A., *See* Otaduy, P.J., 14:36094
Rowland, T.C., *See* Hendriksz, P.J., 14:35998
Roy-Stephan, M., Excitation of the Δ resonance in heavy ion charge exchange reactions, 14:37628 (R;FR)
Roybal, J.A., *See* Henslee, S.P., 14:35846
Rozen, A.M., Prediction and control of extraction ability and some physico-chemical properties of extractants, 14:36859 (RA;SU)
Rozhkovskij, A.A., *See* Zajtsev, S.A., 14:36817
Rozhnov, V.S., *See* Bejder, B.D., 14:36563
Rozno, A.G., *See* Krutyakov, A.N., 14:36637
Rtishchev, V.A., *See* Aslanov, G.A., 14:37726
Rubtsova, I.D., *See* Vladimirova, L.V., 14:37060
Ruchti, R., Development of new scintillating fiber detectors for high energy physics applications, 14:37109 (R;US)
Rudberg, J., *See* Albinsson, Y., 14:36827
Ruddick, J.N.R., A field evaluation of four wood pole groundline preservative formulations using western Canadian wood species, 14:36674 (R;CA)
Rudee, M.L., *See* Green, S.M., 14:36953
Rudik, A.P., *See* Zaritskaya, T.S., 14:36127
Rudisill, T.S., Experimental facilities for pyrochemical development at the Savannah River Site, 14:35817 (R;US)
Rudman, D.A., *See* Coffey, K.R., 14:36944
See Lichtenwalner, D.J., 14:36465
Ruehle, M., *See* Hoel, R.H., 14:36489
Ruggiero, A.G., *See* Di Massa, G., 14:37068
Ruhter, W.D., *See* Gunnink, R., 14:37120
Ruiz, C.P., Modeling hydrogen water chemistry for BWR applications: Final report, 14:35991 (R;US)
Rumyantseva, L.E., *See* Zakharov, Yu.V., 14:36567
Rundle, J.B., Science guide for the Long Valley Caldera deep hole, 14:37412 (R;US)
Rusanova, O.V., Some questions of blastomogenic effect of internal irradiation on mammary gland, 14:37366 (RA;SU;In Russian)
Rushonik, S.I., *See* Shvydko, N.S., 14:37363
Rusin, L.I., *See* Skorovarov, D.I., 14:36719
Russcher, G.E., Managing hazards and evaluating safety in nuclear facilities, 14:35746 (BA;DE)
Russell, D., *See* DuBois, D., 14:37457
Russell, J., *See* Karaffa, M.A., 14:37181
Russell, K.C., Theoretical analysis of phase transformations in Fe-Ni "Invar"-type alloys, 14:36580 (R;US)
Russell, K.D., *See* Sattison, M.B., 14:36174
Russell, T.P., *See* Wignall, G.D., 14:36680
Russo, A.J., *See* Jellison, J.L., 14:36583
Russo, R.E., *See* Spear, J.D., 14:36850
Ruther, W.E., *See* Kassner, T.F., 14:36594
Rutherford, W.M., An efficient palladium isotope chromatograph (EPIC) for hydrogen, 14:36727 (R;US)
Ruutopold, A., Interfaces in composites reinforced with rapidly solidified metallic ribbons, 14:36495 (BA;FR)
Ryabchikov, E.A., *See* Gul'bin, V.V., 14:36568
Ryabenko, E.A., State of and trends in development of production of pure and high-pure compounds of lithium, rubidium and cesium, 14:36805 (RA;SU;In Russian)
Ryabichenko, B.R., *See* Anisimov, V.V., 14:36564
Ryabov, O.L., *See* Agranat, V.Z., 14:37319
Ryan, J., *See* Ruchti, R., 14:37109
Rys'kin, M.P., *See* Baldova, M.V., 14:36786
Rys'kina, M.P., *See* Morozov, V.G., 14:36803
Ryu, H., *See* Bunger, J.W., 14:35706

S

Saadat, S., *See* Balmer, J., 14:37752
Sabaev, E.F., Transients in boiling water cooled channel reactors under loss of control at low power levels, 14:36016 (RA;SU;In Russian)
See Znyshev, V.V., 14:36101
Sabel, H., Seasonal storage of heat for district heating in Sweden, 14:36206 (RA;CA;In English and French)
Saboungi, M.L., Structural and thermodynamic evidence for the survival of Zintl ions through the melting process: The alkali-lead alloys, 14:36662 (R;US)
Sackett, J.I., Development and application of AI technology to plant operation and support, 14:36109 (J;NL)
See White, J.D., 14:36027
Sadler, W., *See* Srajer, V., 14:35573
Sadounik, I., *See* Pian, C.C.P., 14:36354
Saenko, V.A., *See* Vorozhtsov, S.B., 14:37062
Safonov, V.V., Physicochemical study of interaction in the systems Li_2O-TeO_2-M_nO_m (M-Cr, Mo, Ti; n=1.2; m=2.3), 14:36762 (RA;SU;In Russian)
Sahmoune, A., *See* Sastre, A., 14:36833
Saindrenan, G., *See* Charai, A., 14:36506
Saint-Laurent, F., *See* Suraud, E., 14:37608
Saito, G., *See* Noji, K., 14:35986
Saix, C., Capacity of saturated or unsaturated soil to restore calories by gelation, 14:36202 (RA;CA;In English and French)
Sakai, M., *See* Suganami, T., 14:36390
Sakasai, Akira, *See* Nishino, Nobuhiro, 14:37733
Sakharov, N.V., *See* Askinazi, L.G., 14:37723
Sakharovskij, Yu.A., Homogeneous activation of molecular hydrogen: on the development of effective catalysts for isotopic exchange in protolytic media, 14:36816 (RA;SU;In Russian)
Sakhno, T.V., *See* Kovalev, A.E., 14:36799
Sal'nikov, N.L., *See* Kozin, I.O., 14:36107
Salama, Ahmed, I.A., Canadian coal preparation process-control research and development directions, 14:35516 (R;CA)
Salathe, D., *See* Maix, R.K., 14:36919
Salbu, B., *See* Lydersen, E., 14:37263
Saleh, R., *See* Jordan, S.E., 14:35847
Sales, B.C., *See* Christen, D.K., 14:36952
Sales, G.S., *See* Reinisch, B.W., 14:37452
Salinas, L.I., *See* Perucca, J.C., 14:37403
Saljoughian, M., *See* Morimoto, H., 14:36845
Salk, M.S., *See* Houlberg, L.M., 14:37220
Salon, S., *See* Hodgdon, M.L., 14:37480
Saltzman, N., *See* Rial, J.A., 14:35939
Samain, A., *See* Ghendrih, P., 14:37719
Samant, M.G., *See* Kortright, J.B., 14:36854
Samara, G.A., Breathing mode lattice relaxation associated with carrier emission and capture by deep electronic levels in silicon, 14:36689 (BA;US)
See Farmer, J.W., 14:36700
Sammells, A.F., Electrochemical conversion of C(1) molecules. Final report, February 1, 1986-December 31, 1988, 14:35861 (R;US)
Samojlov, Yu.M., Extraction separation of matrix during flame-photometric and atomic-absorption determination of Li, Rb, Cs in alkaline earth element salts, 14:36714 (RA;SU;In Russian)
Sampson, W.B., Normal state resistance and low temperature magnetoresistance of superconducting cables for accelerator magnets, 14:36946 (J;US)
See Garber, M., 14:36936
See Ghosh, A.K., 14:36933
Samuelson, L., Cognition and order in Langmuir-Blodgett films of a 3-hexadecyl pyrrole and ferrocene-derivatized pyrrole mixed monolayer system, 14:36659 (R;US)
Sanchez, M., *See* Rajani, B., 14:35734
Sand, J.R., [Discussion of domestic refrigerator/freezer (R/F) design for nonazeotropic refrigerant mixtures (NARMs), Hannover, W. Germany, and visit to Kassel, W. Germany, May 2–5, 1989]: Foreign trip report, 14:36387 (R;US)
Sanders, G.H., $K^0_L \rightarrow \mu\mu$ polarization: Future prospects, 14:37512 (R;US)

Precision electroweak physics with neutrinos at Los Alamos, 14:37526 (R;US)
Sanders, M.E., *See* Attig, R.C., 14:36349
Sanderson, M.R., *See* Steitz, T.A., 14:37297
Sandor, L., Experiments with one-meter hydrogen bubble chamber in beams of relativistic light nuclei, 14:37508 (RA;CS;In Slovak)
Sandubrae, J., *See* Beninga, K., 14:35926
Sandusky, W.F., *See* Gillman, R.A., 14:36340
Sanford, T.W.L., Compound-lens diode for HERMES III, 14:37092 (R;US)
Sang, H.M., *See* Finnegan, D.J., 14:37311
Sangster, T.C., *See* Fields, D.J., 14:37600
Sankaranarayanan, K., Mobile genetic elements, spontaneous mutations, and the assessment of genetic radiation hazards in man, 14:37342 (RA;US)
Sankey, B.M., Mild thermal conversion of Cold Lake bitumen, 14:35713 (RA;CA)
Sansoni, B., *See* Alian, A., 14:36720
Sanz Fernandez de Cordob, Spectral evolution of SN 1987A in the IUE long wavelength range, 14:37429 (RA;FR)
Saperov, S.K., *See* Stepanov, A.I., 14:37652
Sappa, N.N., *See* Vdovin, S.A., 14:37722
Saprykin, E.M., *See* Gorobunov, V.P., 14:36105
Sarma, B.K., *See* Baum, H.P., 14:36902
Sartory, W.K., Effect of peak thermal strain on simplified ratchetting analysis procedures, 14:36084 (R;US)
Sarychev, V.A., GAVROSh program complex abstract, 14:36020 (RA;SU;In Russian)
Sasaki, Misao, Gravitational lensing and finite beam-width effect on cosmic microwave anisotropies, 14:37442 (R;JP)
Sasaki, Noriaki, *See* Torata, Shin-ichiro, 14:35800
Sasaki, S., *See* Inoue, Z., 14:36644
Sass, S.L., *See* Fitzsimmons, M.R., 14:36485
See MacKenzie, R.A.D., 14:36492
Sastre, A., Synergic extraction of metals with 4-acylpyrazol-5-ones and grown ethers, 14:36833 (RA;SU)
See Figuerola, E., 14:36840
Sastri, V.S., Corrosion inhibition in sour media, 14:36469 (R;CA)
Sataev, E.A., Approximation of the slowing-down equation solution by the discontinuous finite element method, 14:36073 (RA;SU;In Russian)
Sattison, M.B., Microcomputer-based systems and plant analyses - the IRRAS and SARA systems, 14:36174 (BA;DE)
See Batt, D.L., 14:36053
Saunin, E.I., *See* Krutyakov, A.N., 14:36636, 14:36637
See Kuranov, K.E., 14:36790
See Kurilenko, L.I., 14:36769
Sauty, J.P., Presentation of a software package for automated evaluation of soil heat storage projects, 14:36210 (RA;CA;In French)
Sauvage, J., *See* Bourgeois, C., 14:37627
See Kilcher, P., 14:37594
Savage, M.J., *See* Grinstein, B., 14:37538
Savander, V.I., *See* Sarychev, V.A., 14:36020
Savard, G., *See* Le Blanc, F., 14:37592
Savenkov, I.S., *See* Bukhalova, G.A., 14:36788
Savenkova, M.A., On the interaction of lithium and cesium phosphates of metaphosphate composition with bismuth metaphosphate, 14:36755 (RA;SU;In Russian)
Properties of mixed polyphosphates of silver and rare alkali metals, 14:36754 (RA;SU;In Russian)
See Mardirosova, I.V., 14:36747
Savoie, C.L., Practical applications of X-radiography techniques in tar sands, 14:35732 (RA;CA)
Sawa, Kazuhiro, *See* Baba, Osamu, 14:36021
Sayer, R., *See* Simmons, M., 14:37390
Saylor, C.F., *See* Tomljanovich, D.A., 14:35897
Saylor, D.K., *See* Lees, M.G., 14:35959
Sazhenkov, A.Yu., *See* Masloboev, V.A., 14:36751
Sborchia, C., *See* Zichy, J.A., 14:36915
Scanlan, R.M., *See* Gilbert, W.S., 14:36913
See Gregory, E., 14:36938
Schaefer, D.A., Net throughfall chemistry and atmospheric deposition at two forests of different elevations, 14:35924 (J;US)
Schaefer, H., Demand-side management in the Federal Republic of Germany, 14:36329 (RA;US)
Schaefer, J., Research in photovoltaics, 14:36342 (RA;US)
Schaefer, J.C., Status of photovoltaics for commercial power generation, 14:36343 (RA;US)
Schaetzle, W.J., The aquifer chill storage project at the University of Alabama, Tuscaloosa: Progress report for 1985 and 1986, 14:36218 (R;US)
Schaffer, A.C., First evidence for direct cp violation, 14:37544 (R;FR)
Schaffer, G., Cost of a normalconducting linac structure, 14:37041 (R;US)
Cost projection for a superconducting linac structure, 14:37042 (R;US)
Summary of Linac Group discussions, 14:37043 (R;US)
Schaich, C.R., *See* Langley, R.A., 14:37758
Schapink, F.W., *See* Tichelaar, F.D., 14:36497
Scharlemann, E.T., *See* Shay, H.D., 14:36966
Schauer, M.W., Composition and structure of the passive oxide film on iron as observed by second harmonic generation, 14:36650 (BA;US)
Scheeline, A., Spatial structure of transient plasmas revealed with a CCD camera, 14:37746 (BA;US)
Schenk, H., On the construction of certain instanton bundles over flat tori, 14:37546 (R;DE)
Schenstrom, A., *See* Baum, H.P., 14:36902
Scherpelz, R.I., Calculated and measured depth dose profiles in a phantom exposed to neutron radiation fields, 14:37662 (R;US)
Schilder, V., Handling and disposal of waste drilling fluids from on-land sumps in the Northwest Territories and Yukon, 14:35660 (R;CA)
Schiller, D., MHD plasma velocity measurement using correlation techniques, 14:36359 (BA;US)
Schillmoller, C.M., Aspects of alloy selection in thermal recovery of heavy crudes and tar sands, 14:36467 (RA;CA)
Schirber, J.E., *See* Venturini, E.L., 14:36647
Schloss, J.H., *See* Eden, J.G., 14:36968
Schmale, D.T., A test system for thermomechanical fatigue of solder joints, 14:36585 (R;US)
Description of the NanoΔIndenter™; An ultra-low-load microhardness indentation test machine, 14:36996 (R;US)
Schmalfeld, J., *See* Weiss, H., 14:35705
Schmauder, S., *See* Suga, T., 14:37675
Schmerling, M., *See* Persad, C., 14:36611
Schmidt, C., *See* Palkovic, J.A., 14:37051
Schmidt, C.E., *See* Perry, M.B., 14:35560
Schmidt, U., *See* Schubert, B., 14:37171
Schmidt-Boecking, H., *See* Toburen, L.H., 14:37663
Schmit, C.R., *See* Hassett, D.J., 14:37217
Schmitt, E.W., *See* McClaine, A.W., 14:36353
Schneider, R.L., *See* Sharitz, R.R., 14:37213
Schneider, W.F.W., *See* Heusch, B., 14:37587
Schnetzer, E.E., *See* Darnell, R.A., 14:35851
Schnitzer, H.J., *See* Kirsch, L.E., 14:37494
Schobert, H.H., *See* Eser, Semih, 14:35643
Schoedel, A.E., *See* Lees, M.G., 14:35959
Schooley, C.N., *See* Ho, H.M., 14:36685
Schreiber, G.A., Biological indicators for giving proof of exposure to ionizing radiation - lectin coupling to human blood cells possibly a 'biological dosemeter'?, 14:37376 (R;DE;In German)
Schrire, D., Rod overpressure experiment (ROPE). Pre-project, 14:35995 (R;SE)
Schrock, R.R., Chemistry of bimetallic linked cyclopentadienyl complexes: Progress report, 1 December 1986–30 November 1989, 14:36738 (R;US)
Schubert, B., Studies as to the measurement and the chemistry of formaldehyde and acetaldehyde in the lower troposphere, 14:37171 (R;DE;In German)
Schubert, F., *See* Roedig, M., 14:36571
Schuck, P., *See* Suraud, E., 14:37608, 14:37762
Schudel, J.V.H., Column efficiency determination, 14:36730 (BA;US)
Schuler, K.W., *See* Gunter, R., 14:37023
Schulman, B.L., A fundamental research program in coal/heavy oil coprocessing and heavy oil processing: Final report, 14:35523 (R;US)

Schultz, M., *See* Gropp, W., 14:37478
Schulz, N., *See* Mikhajlov, I.N., 14:37631
Schulz, W.W., Multifunctional organophosphorus extractants: a status report on development and applications, 14:35764 (RA;SU)
Schulze, W., *See* Montano, P.A., 14:37477
Schumann, M., Effective implementation of safeguards and security requirements, 14:37790 (R;US)
Schuster, K.F., Development of new type of silicon detector with internal amplification, 14:37117 (R;DE;In German)
Schutt, J.A., Numerical solution of the Navier-Stokes equations for three-dimensional incompressible flows with open boundaries, 14:37484 (R;US)
Schwartzman, A., Application of quaternary phase diagrams to compound semiconductor processing: Progress report, April 1–December 31, 1988, 14:36480 (R;US)
Schwarz, A., *See* Adolphsen, C., 14:37096
Schwarz, H.D., *See* Jobe, R.K., 14:37094
Schwatz, R.B., *See* Zeman, G.H., 14:37098
Schweikert, E.A., *See* Della Negra, S., 14:37471
Schwenterly, S.W., Influence of dump voltage and allowable temperature rise on stabilizer requirements in superconducting coils, 14:36927 (J;US)
See Lue, J.W., 14:36929
Schwinn, E., *See* Jahnke, U., 14:37603
Scott, A.G., Recreating the uranium mining environment of the 1950's, 14:35751 (RA;CA)
Scott, B., *See* Abrahamson, S., 14:37380
Scott, C.D., Bioprocessing research for energy applications, 14:35905 (R;US)
Microbial coal liquefaction, 14:35520 (R;US)
Techniques for producing monodispersed biocatalyst beads for use in columnar bioreactors, 14:36665 (R;US)
Scott, J.D., Sand control with geotextile filters, 14:35628 (RA;CA)
See Dusseault, M.B, 14:35738
See Laing, J.M., 14:35720
Scott, J.P., *See* Anderson, G.R., 14:37388
Scott, L., Composite media prepacks for sand control in heavy oil production, 14:35621 (RA;CA)
Scott, M.L., Response of wetland herb communities to gradients of disturbance and substrate, 14:37214 (J;US)
Scott, T.C., Modeling of flow fields in oscillating droplets, 14:36983 (BA;US)
Scutaru, H., *See* Iosifescu, M., 14:37701
Seaborg, G.T., Journal of Glenn T. Seaborg (Chairman, US Atomic Energy Commission, 1961 through 1971), July 1, 1961–December 31, 1961, 14:36249 (R;US)
Journal of Glenn T. Seaborg, Chairman of the US Atomic Energy Commission, 1961–1971: Volume 1, February 1, 1961–June 30, 1961, 14:36248 (R;US)
Seba, P., Klein's paradox and the relativistic point interaction, 14:37710 (R;DE)
Sebille , F., *See* Suraud, E., 14:37762
Sebille, F., *See* Suraud, E., 14:37608
Sedov, V.M., Determination of thermodynamic characteristics of extraction equilibria in the systems containing ammonium salts and organic phosphorus compounds, 14:36717 (RA;SU)
Sedov, Yu.S., *See* Belousov, A.N., 14:36566
Seehusen, J., Implatation of MC2 computer code, 14:36068 (R;BR;In Portuguese)
Seeker, W.R., *See* LaFond, J.F., 14:35591
Seguinot, J., *See* Arnold, R., 14:37101
Sehlberg, T., *See* Nordell, B., 14:36201
Seibel, R.M., *See* Groenemeyer, D.H., 14:37317
Seidman, D.N., *See* Herschitz, R., 14:36512
Seip, H.M., Acidification and water pathways. What about the future?, 14:37273 (RA;NO)
Seip, R., *See* Toburen, L.H., 14:37663
Sekino, M, *See* Sice, H., 14:35637
Sekula, S.T., Superconductivity, critical current density, and magnetic properties of Fe-substituted $Y_1Ba_2(Cu_{1-x}Fe_x)_3O_z$ materials, 14:36949 (J;US)
See Christen, D.K., 14:36952
Selby, G., Feature-enhanced-imaging field trials: Peach Bottom Unit 3: Interim report, Phase 2, 14:35992 (R;US)
Selby, K.B., *See* Killinger, M.H., 14:37276
Selig, W.S., A new potentiometric method for the estimation of the rare earth elements, 14:36851 (BA;US)
Seliskar, C.J., *See* Dosser, L.R., 14:37152
Selivanov, V.M., Methods and programs for calculating dynamics of thermal-hydraulics processes in nuclear reactors, 14:36071 (RA;SU;In Russian)
See Opanasenko, A.N., 14:36008
Sellman, M.B., Training: expectations of an operations superintendent, 14:36054 (RA;US)
Sellmyer, D.J., Fundamental magnetic studies of iron-rare-earth-metalloid alloys: Technical performance report, 14:36483 (R;US)
Sellschop, J.P.F., *See* Conell, S., 14:37677
Semakin, I.V., *See* Zakharov, Yu.V., 14:36567
Semenov, G.A., Mass spectrometric study of evaporation of rubidium and cesium vanadates, 14:36771 (RA;SU;In Russian)
Semler, M.O., Radiological survey of San Diego Bay, 14:37279 (R;US)
Semrad, E.E., Thermogravimetric study of formation process and properties of cesium tantalum oxides, 14:36772 (RA;SU;In Russian)
Sengupta, S., Insolation and characterization of non-bituminous organic materials which may interfere with recovery of bitumen from oil sands, 14:35716 (RA;CA)
Seperack, P.K., *See* Strobel, M.C., 14:37306
Seppanen, O., Comparison of conventional mixing and displacement air conditioning and ventilating systems in US commercial buildings, 14:36386 (R;US)
Serebryakova, N.V., *See* Kurilenko, L.I., 14:36769
Sergeeva, L.V., ELL program abstract, 14:36092 (RA;SU;In Russian)
Sergei, R.P., Guaranteed rates: a marketable option?, 14:36321 (RA;US)
Sergolle, H., *See* Bourgeois, C., 14:37591, 14:37593
Serot, D.E., Oil use and oil dependency: Long-term issues, 14:35654 (R;US)
Serpemen, Y., *See* Galiasso, R., 14:35704
Sessler, A.M., High-power, high-efficiency FELs, 14:36965 (R;US)
Prospects for the FEL [Free Electron Laser], 14:36964 (R;US)
Setlow, P., Resistance of bacterial spores to ultraviolet light, 14:37339 (R;US)
Setsume, Kentaro, *See* Yoshida, Akihisa, 14:35854
Settari, A., Modelling of fracture and deformation processes in oil sands, 14:37415 (RA;CA)
Severino, G., *See* Gomez, M.T., 14:37422
Severud, L.K., Creep-fatigue assessment methods using elastic analysis results and adjustments, 14:36588 (R;US)
Seya, M., *See* Menlove, H.O., 14:35757
Seyer, W., *See* Leshchyshyn, T., 14:35725
Sezgin, E., *See* Bergshoeff, E., 14:37700
Sha, W.T., Time- and volume-averaged conservation equations for multiphase flow, 14:36979 (R;US)
Shabratova, G.S. and oth, *See* Krasnov, S.A., 14:37598
Shack, W.J., *See* Maiya, P.S., 14:36593
Shafarman, W.N., *See* Birkmire, R.W., 14:35913
Shah, V.N., *See* Ware, A.G., 14:35989
Shakhovets, K.G., *See* Askinazi, L.G., 14:37723
Shalygin, V.A., *See* Zajtsev, S.A., 14:36817
Shan, W., *See* Li, M.F., 14:36699
Shankar, R., *See* Selby, G., 14:35992
Shannon, D.C., *See* Eden, J.G., 14:36968
Shannon, V.L., *See* Richmond, G.L., 14:36369
Shapiro, J.A., What transposable elements do in bacteria, 14:37286 (RA;US)
Shapiro, S.L., *See* Kramer, G., 14:37119
Shapiro, Z.I., *See* Belov, V.V., 14:36776
Shappert, L.B., Cask drop testing and analysis, 14:36869 (R;US)
Sharan, S., *See* Narayan, J., 14:36540
Sharbaugh, R.J., *See* Acton, D.S., 14:37423
Shargorodskij, M.A., *See* Nikolaev, Yu.B., 14:36090
Sharitz, R.R., Regeneration patterns in a southeastern floodplain forest, 14:37213 (J;US)
See Murphy, P.G., 14:37337
Sharma, G.D., Characterization and utilization of natural gas in Alaska: Final report, 14:35670 (R;US)

Sharpe, P.H.G., *See* Barrett, J.H., 14:37100
Shatalov, G.E., *See* Golovin, I.N., 14:37769
Shatas, S., *See* Hahn, S., 14:36694
Shatoff, H., GACAP: A new computer code for analysis of symmetric and nonsymmetric cask cross sections, 14:36871 (R;US)
Shatskaya, S.S., Atomic absorption determination of rubidium and cesium in complex objects, 14:36713 (RA;SU;In Russian)
See Samojlov, Yu.M., 14:36714
Shaw, R.F., *See* Cowan, J.H. Jr., 14:37254
Shay, H.D., Tapering FEL amplifiers in wiggler period and field, 14:36966 (R;US)
Shchavelev, L.N., *See* Butylkin, B.B., 14:36565
Shcheglov, M.A., *See* Voropaev, S.G., 14:37721
Shchegoleva, R.I., *See* Baldova, M.V., 14:36786
See Morozov, V.G., 14:36803
Shcherbak, V.V., *See* Borisov, A.D., 14:37039
Shcherbakov, A.G., *See* Golovin, I.N., 14:37769
Shcherbakova, T.M., *See* Nadzharyan, K.A., 14:36810
Shcherbenok, G.U., Standardization and series production of radiation-shielding items, 14:36874 (RA;SU;In Russian)
Shebolaev, I.V., *See* Ivannikov, V.I., 14:37082
Shebzukhov, M.D., *See* Akchagirov, B.B., 14:36555
Sheehy, J.W., *See* O'Brien, D.M., 14:37179
Sheffer, E.K., *See* Giovannelli, F., 14:37434
Sheffield, J., Panel discussion: Progress and plans for magnetic fusion: Summary of comments on recent progress in fusion research at the Oak Ridge National Laboratory, 14:37716 (R;US)
Sheffield, R.L., High-brightness electron injectors: A review, 14:37088 (R;US)
Shelton, R.B., *See* Katzman, M.T., 14:36274
Shen, S.S., *See* Zichy, J.A., 14:36915
Shenoy, G.K., *See* Montano, P.A., 14:37477
Shepard, K.W., Superconducting low-velocity linac for the Argonne positive-ion injector, 14:37069 (R;US)
See Bohn, C.L., 14:36954
Shepard, T.D., *See* Langley, R.A., 14:37758
Shepard, W.S., Diagnostic development and support of MHD test facilities: Progress report, July–September 1987, 14:36345 (R;US)
Shepherd, E.R., *See* Bonano, E.J., 14:35792
Sheppard, M.G., *See* Parker, J.V., 14:37481
Sherblyuk, E.N., *See* Banik, V.V., 14:36804
Sheridan, T., *See* Sanford, T.W.L., 14:37092
Sherman, J., Influence of a biased beam dump on H^- beam neutralization measurements with a four-grid energy analyzer, 14:37089 (R;US)
Sherman, R.J., *See* Raistrick, I.D., 14:37021
Sherrard, J.R., Simulator application in a nuclear technology degree program, 14:36067 (RA;US)
Shesterikov, V.N., *See* Vashman, A.A., 14:36837
Shestopal, S.A., *See* Belej, A.S., 14:37037
Shevchuk, A.V., *See* Kovalev, A.E., 14:36799
Shevchuk, I.M., *See* Bejder, B.D., 14:36563
Shevchuk, V.G., Formation conditions and some properties of double nitrates of rare alkali metals and rare earths, 14:36781 (RA;SU;In Russian)
Interaction of cesium, nickel and praseodymium (3) sulfates in aqueous solutions, 14:36780 (RA;SU;In Russian)
Interaction of lithium chlorides, nitrates, sulfates with rare earths and hexamethylenetramine in aqueous solutions at 25-100 deg C, 14:36779 (RA;SU;In Russian)
Shevtsov, N.I., *See* Blank, A.B., 14:36712
Shi Nin, *See* Liu Huangfeng, 14:37409
Shibley, P.W.M., *See* Angelov, G., 14:35639
Shih, C.C., *See* Carruthers, P., 14:37540
Shih, D.S., *See* Robertson, I.M., 14:36533
Shimura, Hitoshi, *See* Matsuura, Kiyokata, 14:37804
Shipers, L.R., *See* Bonano, E.J., 14:35792
Shipilov, Yu.Ya., *See* Nikolaev, Yu.B., 14:36090
Shiraishi, Kiyoshi., Compactification of space-time in SU(∞) Yang-Mills theory, 14:37525 (R;JP)
Shiraj, Yu.V., *See* Shevchuk, V.G., 14:36779
See Storozhenko, D.A., 14:36782
Shirokoff, J., Study of long range forces in epitaxy systems: the Ag/Si interface, 14:36621 (BA;FR)
Shishkin, A.A., *See* Zolotukhin, A.V., 14:37724
Shkermotov, V.I., *See* Mozgovoj, A.G., 14:36553
Shkurkina, V.M., *See* Komarov, V.I., 14:36106
Shlygin, O.Yu., *See* Vladimirova, L.V., 14:37060
Shmonin, Yu.V., *See* Komarov, V.I., 14:36106
Shockley, W.E., *See* Beahm, E.C., 14:36186
Shrader, C.R., Simultaneous IUE, exosat, and optical observations of the unusual AM Her type variable H0538+608, 14:37433 (RA;FR)
Shreeve, J.M., Improved acid electrolytes for fuel cells. Final report, July 1985-January 1989, 14:36364 (R;US)
Shrimpton, M., *See* Storey, K., 14:37282
Shubao, X., The thick-getting mechanism and characteristics of terrestrial heavy oil pools in China, 14:35599 (RA;CA)
Shubik, V.M., Combined effect of internal irradiation, alcohol and smoking on some immunological indices, 14:37374 (RA;SU;In Russian)
Shuler, J., Problems and solutions in online documentation systems, 14:37815 (R;US)
Shulika, A.K., *See* Borisov, A.D., 14:37039
Shulika, N.G., *See* Belej, A.S., 14:37037
Shursen, G., *See* Wilkins, D.A., 14:35679
Shurtleff, W.W., Ultrasonic systems and system development at SNL Albuquerque, 14:36997 (R;US)
Shusen Li, *See* Chengye Yuan, 14:36841
Shvetsov, B.V., *See* Polunin, G.V., 14:36873
Shvydko, N.S., On the effect of iron on plutonium metabolic mechanism in liver tissue, 14:37363 (RA;SU;In Russian)
Sice, H., Mild resid hydrocracking for heavy oil upgrading, 14:35637 (RA;CA)
Sideras-Haddad, E., *See* Von Wimmersperg, U., 14:37622
Siegel, R., Parity violation workshop, 14:37502 (R;US)
Siegel, R.W., Structure and properties of nanophase TiO_2, 14:36534 (BA;FR)
Siekevitz, M., *See* Greene, W.C., 14:37329
Sievers, A.J., *See* Gosnell, T.R., 14:36957
Sigalla, L.A., *See* Scherpelz, R.I., 14:37662
Signorelli, E., *See* Romano, P., 14:36956
Silber, A., *See* Shrader, C.R., 14:37433
Silva Filho, A.F. da, Petrology and mapping of Fe and Ti occurences in Passira country, PE, Brazil, 14:36709 (R;BR;In Portuguese)
Silva, R.J., *See* Spear, J.D., 14:36850
Silva, V.M., *See* Batten, J.J., 14:36463
Silverman, B.D., *See* Ho, P.S., 14:36668
Simmons, M., Evaluation of the impact of acid deposition on Eastern Canada's sport fishery, 14:37390 (RA;CA)
Simon, G.W., *See* November, L.J., 14:37421
Simonov, V.D., HOST optimization program complex for management of the WWER internal fuel cycle, 14:36009 (RA;SU;In Russian)
Simons, C.A., Whitehorse efficient woodheat demonstration, 14:35865 (R;CA)
Simons, J.M., *See* Sloan, G.R., 14:37146
Simpkins, J.E., *See* Langley, R.A., 14:37758
Simpson, R.L., The equation of state of perfluorododecane to 48 GPa, 14:36847 (R;US)
Simpson, W.W., *See* Rochau, G.E., 14:37774
Simpson, Y.K., *See* Carter, C.B., 14:36626
Sims, A.J., *See* Dyer, C.S., 14:37129
Sims, W.R., *See* Lorenz, R., 14:37255
Sindelar, R.L., Life extension approach to the reactor vessel of a nuclear production reactor: Revision 1, 14:36126 (R;US)
Sinegribova, O.A., *See* Varnek, A.A., 14:36818
Singer, C.E., Multiple mode model of tokamak transport, 14:37740 (R;US)
Singer, M.F., Functional potential of the human LINE-1 family of interspersed repeats, 14:37288 (RA;US)
Singh, K.N., Appalachian States Compact Low-Level Radioactive Waste management survey, 1987, 14:35799 (R;US)
Singh, N., Magnetic field-aligned plasma expansion in critical ionization velocity space experiments, 14:37459 (J;US)
Singh, S., Reservoir plugging/blocking using ultramicrobacteria: Three-dimensional physical simulator results, 14:35707 (RA;CA)
Sinitsa, V.V., GRVKON-6 applied program package for calculation of neutron group constants, 14:37626 (RA;SU;In Russian)

Sinitsyn, O.A., Chamber for storage and recharging, 14:36876 (RA;SU;In Russian)
Sirmann, R., *See* Barnes, P.D., 14:37496
Sizov, R.A., *See* Drits, M.E., 14:36547
See Potemkin, V.F., 14:36548
Skelton, L.W., Guide to land treatment of municipal waste water in Illinois, 14:36433 (R;US)
Sklad, P.S., The amorphous to gamma transformation in ion implanted Al_2O_3, 14:36618 (R;US)
The preparation of TEM specimens from hazardous or difficult materials, 14:36681 (BA;US)
Skogmo, D., TRACE - Tamper Resistant Authenticated Camera Enclosure, 14:36890 (R;US)
Skorikov, V.M., *See* Shevchuk, V.G., 14:36780
Skorovarov, D.I., Mechanism of extraction of uranium (6) by mixtures of phosphororganic extractants, 14:36864 (RA;SU)
Metal extraction by amides of carboxylic acids, 14:36719 (RA;SU)
Skoryupin, V.A., *See* Golovanov, Yu.P., 14:37767
Skotheim, T.A., *See* Samuelson, L., 14:36659
Skovorod'ko, S.N., *See* Mozgovoj, A.G., 14:36554
Skovoroda, A.A., *See* Golovin, I.N., 14:37769
See Zhil'tsov, V.A., 14:37765
Skowronski, J., *See* Singer, M.F., 14:37288
Skrinak, V.M., Documentation and review of Eastern Gas Shales Technology. Annual report, April 1, 1984-March 31, 1985, 14:35671 (R;US)
Slabospitskij, R.P., *See* Borisov, A.D., 14:37039
Slack, M.W., Investigation of a premium casing connection for Canadian thermal recovery wells, 14:35627 (RA;CA)
Slavik, J.N., Environmental mediation in major oil sands developments. An alternative model to resolution of native, corporate and government interests in resource development approval processes, 14:35741 (RA;CA)
Slivko, T.A., Synthesis and study of some properties of mixed hexacyanoferrates (3) of rare alkali and alkaline-earth elements, 14:36789 (RA;SU;In Russian)
See Arkhipov, S.M., 14:36806
Sloan, G.R., A fully automated, single-connection tester for T/R modules, 14:37146 (R;US)
Slobodin, B.V., Systems MVO_3-$Zn(VO_3)_2$ and MVO_3-$Mn(VO_3)_2$, where M=Li, Rb, Cs, 14:36770 (RA;SU;In Russian)
See Kristallov, L.V., 14:36775
See Semenov, G.A., 14:36771
Slovacek, R.E., *See* Block, R.C., 14:37605
Slutz, S.A., *See* Hussey, T.W., 14:37483
Smalley, G., *See* Wright, C., 14:36268
See Yanchar, J.M., 14:36265
Smelov, V.S., *See* Vashman, A.A., 14:36837
Smigelski, L.B., Indoctrination: using interactive video to teach attitudes and knowledge in general employee training, 14:35827 (RA;US)
Smirnov, A.A., *See* Bol'shakov, V.I., 14:36017
Smirnov, L.V., Equation derivation and studying the dynamics of NPP cooling systems, 14:36087 (RA;SU;In Russian)
Smirnov, S.B., Determining the carrying capability of composite plates in power plant structures taking into account attenuating effect of joints in them, 14:36089 (RA;SU;In Russian)
Method for calculating plane reinforced concrete elements of walls and ceilings in power plant structures under limiting loads, 14:36088 (RA;SU;In Russian)
Smirnov, V.L., *See* Bystrov, V.M., 14:37080
Smirnova, O.M., *See* Banik, V.V., 14:36807
Smit, B., *See* Brklacich, M., 14:37167
See Ludlow, L., 14:37218
Smith, A.B., Optical-model calculations for experimental interpretation and evaluation: Practical considerations and fundamental implications, 14:37614 (RA;XA)
Some fundamental aspects of the optical potential for the interaction of fast neutrons with cobalt, 14:37613 (RA;XA)
See Chiba, S., 14:37585
Smith, A.V., Coherent VUV source at 130 nm, 14:36974 (BA;US)
Smith, D.A., Atomic level observation of grain boundaries in metals, 14:36484 (BA;FR)
Using variable prices to improve productivity, 14:36306 (RA;US)
Smith, D.B., Multiphoton ionization of $(Xe)_n$ and $(NO)_n$ clusters using a picosecond laser, 14:37464 (R;US)
Smith, D.J., *See* Merkle, K.L., 14:36627
Smith, D.L., *See* Geraci, C.L., 14:37180
Smith, R.D., Electrospray ionization and collision induced dissociation of large multiply charged ions, 14:37475 (R;US)
Reverse micelles in supercritical fluid chromatography, 14:35644 (BA;US)
Speculation on the mechanism(s) of electrospray ionization, 14:37143 (R;US)
See Jones, H.K., 14:36731
See Loo, J.A., 14:36846, 14:37141
See Udseth, H.R., 14:37142
Smith, S.T., LAVA [Los Alamos Vulnerability and Risk Assessment] and classical risk analysis, 14:35838 (R;US)
Smith, T.A., *See* Love, R.G., 14:37191
Smith, T.E. Jr., *See* Shay, H.D., 14:36966
Smith, T.L., *See* Vanderlaan, J.F., 14:37761
Smith, W., *See* LeBlanc, W., 14:36275
Smith, W.H., *See* Court, A.L., 14:35728
Smith, W.M., From rates to prices: the emerging concepts, 14:36277 (RA;US)
Institutional aspects of DSM in the United States, 14:36330 (RA;US)
Motivations for and evolution of DSM, 14:36326 (RA;US)
Smithson, R.C., *See* Acton, D.S., 14:37423
Smorodintseva, G.I., *See* Poplavskij, K.K., 14:37650
Smyth, D., *See* Mills, A.W., 14:36470
Sneed, C., *See* Lenoir, Y., 14:36381
Snell, M., The Outsider interruption algorithm, 14:35849 (R;US)
Snow, W.M., *See* Herwig, K.W., 14:37639
Snucins, E.J., *See* Lumatainen, V.A., 14:37391
Soares, I.D., *See* Rodrigues, L.M.C.S., 14:37426
Sobell, H.M., A soliton mechanism for DNA melting: Progress report, November 1, 1988–October 31, 1989, 14:37298 (R;US)
Sobels, F.H., Mutation induction by MR(P) and its modification by various conditions, 14:37341 (RA;US)
Soda, Kunihisa, *See* Muramatsu, Ken, 14:35993
Soderstrom, E.J., Negotiating a license to government technology, 14:36241 (R;US)
Providing incentives for effective technology transfer, 14:36246 (J;US)
Sogomonova, R.A., *See* Savenkova, M.A., 14:36754
Sokol, P.E., *See* Herwig, K.W., 14:37639
Sokolov, A.V., *See* Monakhov, A.S., 14:37367
Sokolov, B.V., *See* Agranat, V.Z., 14:37319
Solari, R.B., *See* Weiss, H., 14:35705
Solbes, A., Coal-fired MHD power train performance test results, 14:36355 (BA;US)
Solin, L., *See* Enstroem, H., 14:36421
Solin, S.A., *See* Hoffman, D.M., 14:36696
Solomon, D.K., *See* Yeh, G.T., 14:35796
Sommer, D.J., Liquid effluent study project plan, 14:35815 (R;US)
Soniassy, R., *See* Schilder, V., 14:35660
Sonneborn, G., *See* Sanz Fernandez de Cordoba, L., 14:37429
See Starrfield, S., 14:37437
Sonnenburg, H.G., *See* Wolfert, K., 14:36151
Sonnichsen, J.C., *See* Sommer, D.J., 14:35815
Soo, P., A study of the use of crosslinked high-density polyethylene for low-level radioactive waste containers, 14:35794 (R;US)
Soo, S.L., *See* Sha, W.T., 14:36979
Soppet, K., *See* Kassner, T.F., 14:36594
Sorby, P., *See* Webb, J., 14:37348
Sorem, M.E., *See* Harris, D.B., 14:37770
Sorem, W.A., *See* Wellman, G.W., 14:36602
Sorensen, J.H., *See* Adler, V., 14:37344
Sorensen, N.A., Is the deposition of anthropogenic sulphate onto Scandinavia mature for a harrowing reconsideration ?, 14:37258 (RA;NO)
Sorensen, N.R., Atmospheric corrosion and inhibition of copper, 14:36595 (BA;US)
See Helfand, M.A., 14:36366
Sornborger, A., *See* Cutts, D., 14:37106
Sornborger, A.T., *See* Barter, C., 14:37104
Sosnick, T.R., *See* Herwig, K.W., 14:37639

Southworth, F., *See* Janson, B.N., 14:36402
Sowle, D.H., *See* Lowen, R.W., 14:37154
Spady, E.K., *See* Hyndman, L.D., 14:35690
Sparks, B.D., *See* Kotlyar, L.S., 14:35733
Sparks, W.M., *See* Starrfield, S., 14:37437
Spear, J.D., Background correction in photothermal deflection spectroscopy using a single position sensor, 14:36850 (BA;US)
Speight, J.G., *See* Moschopedis, S.E., 14:35518
Spence, P.W., *See* Sanford, T.W.L., 14:37092
Spencer, B., *See* Purvis, E.E., 14:36183
Spencer, F.S., *See* Brown, R.M., 14:37225
Spiegelberg, A., *See* Schreiber, G.A., 14:37376
Spilrain, E.E., Laboratory examinations of a new downhole steam generator, 14:35605 (RA;CA)
Spingarn, J.R., *See* LaJeunesse, C.A., 14:36884
Spitzig, W.A., *See* Trybus, C.L., 14:36599
Sprinkle, J.K. Jr., HEU [highly enriched uranium] drum monitor manual (for confirmatory measurements), 14:35768 (R;US)
Spulak, R.G. Jr., Effects on consequences of the high steam content in LWR accident releases, 14:36195 (BA;US)
Spulber, D.F., Competition and bypass in regulated markets, 14:36289 (RA;US)
Spurgin, A.J., *See* Worledge, D.H., 14:36133
Srajer, V., The selection, development and testing of an integrated truck/shovel management system, 14:35573 (R;CA)
See Kempe, A.B., 14:35571
Srinivasan, M.G., *See* Hsieh, B.J., 14:36085, 14:36143
Srinivasan, S., Electrode materials and processes for energy conversion and storage, 14:36223 (B;US)
Srinivasan, V., [2nd international symposium on high-temperature corrosion of advanced materials and coatings, Les Embiez, France, May 22–26, 1989]: Foreign trip report, 14:35537 (R;US)
Srivastava, P.C., *See* Knapp, F.F. Jr., 14:37320
Srolovitz, D.J., *See* Chen, S.P., 14:36488
Stacey, W.M. Jr., Review of effects of NBI [neutral beam injection] and rotation on plasma transport in tokamaks, 14:37720 (R;US)
Stadelmann, P., *See* Mills, M.J., 14:36493
Stadman, T.C., Identification and characterization of reaction steps and enzyme catalysts involved in the conversion of acetate and methyl groups to methane. Final report, October 1984-October 1987, 14:35860 (R;US)
Stajkov, A.I., *See* Nadzharyan, K.A., 14:36810
Stalker, K.T., Real-time optical processor for synthetic aperture radar image formation, 14:37020 (BA;US)
Stangeby, P.C., *See* Haasz, A.A., 14:37755
Starrfield, S., Observations and simulations of Nova Vul 1984 2: a Nova with ejecta rich in oxygen, neon, and magnesium, 14:37437 (RA;FR)
Start, G.E., *See* Gudiksen, P.H., 14:37164
Stasevich, Yu.B., *See* Kozodaev, A.M., 14:37084
Stasiewicz, K., *See* Marklund, G.T., 14:37447
Stasko, R., Canadian contributions to the safety and environmental aspects of fusion, 14:37757 (R;CA)
Stechel, E.B., Pairing in CuO_2 driven by exchange interactions between carriers and localized Cu spins, 14:37476 (R;US)
Steele, W.V., Thermodynamic equilibria in the biphenyl/hydrogen system (The power and limitations of group additivity estimations): Topical report, 14:35664 (R;US)
Steen, Aa., Investigations of auroral dynamics: techniques and results, 14:37453 (R;SE)
Steeves, M.M., *See* Hoenig, M.O., 14:36907
Stefani, F., A heat-driven monochromatic light source, 14:37751 (J;US)
Stefanovich, S.Yu., *See* Proskuryakova, E.V., 14:36759
Stege, H., *See* Heusch, B., 14:37587
Steidl, D.V., *See* Johnson, I., 14:36185
Stein, H.J., Interactions of implanted carbon with oxygen and nitrogen in silicon, 14:36692 (BA;US)
See Hahn, S., 14:36694
Stein, W., Stemming temperature changes during emplacement: Experimental results and analysis, 14:36982 (R;US)
Steiner, D., *See* Varsamis, G., 14:37756
Steitz, T.A., Structural studies of Klenow fragment: an enzyme with two active sites, 14:37297 (BA;US)
Stelmakh, A.P., *See* Arakelian, S.G., 14:37520, 14:37521
Stemmet, M.S., *See* Conell, S., 14:37677
Stempvoort, D.R. van, Oxygen isotopic composition of sulphates in the uplandforest of the plastic lake watershed, 14:37237 (RA;NO)
Stepan, I., *See* Funk, G., 14:36350
Stepanov, A.I., On improved medical surveillance of personnel operating with radiation sources, 14:37652 (RA;SU;In Russian)
Stephenson, M.B., Using conjoint meshing primitives to generate quadrilateral and hexahedral elements in irregular regions, 14:37810 (R;US)
Stepin, B.D., *See* Yakimova, E.E., 14:36710
Stern, K.M., Modifying process operations in response to innovative pricing, 14:36305 (RA;US)
Stevens, P.A., *See* Hornung, M., 14:37243
Stevens, R.J.J., *See* Neilson, M.A., 14:37257
Stevens, S., *See* Truett, T., 14:37800
Stevenson, R.J., *See* Hassett, D.J., 14:37217
Stewart, D.A., *See* Bone, R.M., 14:37283
Stewart, M.M., *See* Lees, M.G., 14:35959
Stickle, W.F., *See* Chin, D.K., 14:36899
Stickler, D.B., *See* Hemsath, K.H., 14:36419
Stine, W.B., Progress in parabolic dish technology, 14:35930 (R;US)
Stinnett, R.W., Ion diode experiments on PBFA [Particle Beam Fusion Accelerator] II: Workshop on applications of high power switching, 14:37780 (R;US)
Stinton, D.P., Characterization of fiber-reinforced particulate filters, 14:35961 (R;US)
Stoddard, G.B., *See* Evans, E.P., 14:37002
Stohr, J., *See* Greeger, R.B., 14:36649
Stokely, J.R., International conference on analytical chemistry in nuclear technology, June 5–8, 1989, Karlsruhe, France: Foreign trip report, 14:36729 (R;US)
Stokes, A.W., *See* Laing, J.M., 14:35720
Stokes, P., Airborne contaminants and aquatic systems. An assessment of research needs, 14:37395 (R;CA)
Stokowski, S.E., Nd:Cr:GSGG, will it replace Nd:YAG, 14:36971 (BA;US)
Stokstad, R.G., *See* Pouliot, J., 14:37599
Stoler, D.L., *See* Anderson, G.R., 14:37388
Stone, M.E., *See* Fast, R.W., 14:36925
Stone, S.K., Team maintenance as a result of team training, 14:36057 (RA;US)
Stoneham, A.M., Understanding oxide-metal interfaces, 14:36620 (BA;FR)
Stoops, J.L., Performance monitoring protocols, 14:36393 (R;US)
Storey, K., Planning for large-scale construction projects. A socio-economic guide for communities, industry, and government, 14:37282 (R;CA)
Storm, D.W., Superconducting booster project: [Final report], 14:37072 (R;US)
Storozhenko, D.A., Synthesis and physicochemical study of double chlorides, nitrates, sulfates of rubidium and cesium with calcium, lanthanum, neodymium, ytterbium, 14:36782 (RA;SU;In Russian)
See Shevchuk, V.G., 14:36779
Stotler, D.P., Pulse length assessment of compact ignition tokamak designs, 14:37739 (R;US)
See Singer, C.E., 14:37740
Stout, M.G., *See* Rollett, A.D., 14:36572
Stovall, L.A., *See* Sprinkle, J.K. Jr., 14:35768
Stoyanov, S., *See* Chu Tsonglun, 14:36178
Stoyanov, Ye.S., *See* Torgov, V.G., 14:36863
Strait, J., Tests of full scale SSC R and D dipole magnets, 14:36912 (J;US)
Strand, D.J., *See* McDonald, J.F., 14:37312
Strandberg, G.W., *See* Scott, C.D., 14:35520
Strawn, J., *See* Kelkar, S., 14:35680
Strayer, M.R., *See* Bottcher, C., 14:37498
Streit, R.D., *See* Riddle, R.A., 14:36597
Strekalov, S.A., *See* Monakhov, A.S., 14:37367
Strel'nikova, N.K., Comparative radiosensitivity of oocytes of various stages of maturity, 14:37361 (RA;SU;In Russian)
Strelow, F., *See* Eisenhut, W., 14:35535
Stremel, J., Marginal operating costs: is system lambda enough?, 14:36281 (RA;US)

Strenge, D.L., *See* Kennedy, W.E., Jr., 14:35785
Strickland, B.E., *See* Freeman, B.L., 14:37009
Strobel, M.C., Molecular genetic studies of the mouse dilute locus: analysis of two dilute alleles and dilute-suppressor, 14:37306 (RA;US)
Strong, W., Woodchip production and transporation in Newfundland. Overview, 14:35866 (RA;CA)
Struble, G.L., *See* Fields, D.J., 14:37600
Struckmeyer, R., NRC TLD [thermoluminescent dosimeter] Direct Radiation Monitoring Network: Progress report, January–March 1989, 14:37228 (R;US)
Strum, M.J., Ductility enhancement in unreacted internal-Sn Nb_3Sn through low-temperature anneals, 14:36948 (J;US)
Stryker, L.L., *See* Starrfield, S., 14:37437
Stucky, M., Characterization by positron annihilation of vacancies in gallium arsenide, 14:36675 (R;FR;In French)
Stumpff, N.J., *See* Donovan, L.A., 14:35916
Stutte, L., *See* Womersley, W.J., 14:37122
Styers, D.R., Assessment of potential worker exposure for the Tumulus Disposal Demonstration Project: Fiscal year 1988 annual report, 14:35798 (R;US)
Suga, T., Interface crack models, 14:37675 (BA;FR)
Suganami, T., Research and development on a 3-kW-class Stirling engine, 14:36390 (R;JP)
Suggett, J.C., *See* Laing, J.M., 14:35720
Sugie, Tatsuo, *See* Nishino, Nobuhiro, 14:37733
Sugimoto, Jun, *See* Iwamura, Takamichi, 14:36010
Sugiyama, Naoshi., Gauge invariant cosmological perturbations with cold dark matter, 14:37530 (R;JP)
Suglobova, I.G., *See* Baluev, A.V., 14:36862
Sukal'skaya, S.Ya., Modeling of combined effect of alcohol, tobacco smokes and internal irradiation of laboratory animals, 14:37375 (RA;SU;In Russian)
Sukhanovskaya, A.I., *See* Fakeev, A.A., 14:36811
Sukhovitskij, E.Sh., *See* Klepatskij, A.B., 14:37625
Sukhovoj, A.M., *See* Boneva, S.T., 14:37633
Sulejmanov, E.V., *See* Egorov, N.P., 14:36795
Sullivan, R.L., Measuring outage probabilities, 14:36288 (RA;US)
Sullivan, T.J., NASA Lewis Stirling engine computer code evaluation, 14:36448 (R;US)
Summerfelt, S.R., *See* Carter, C.B., 14:36626
Summers, L.T., The effect of transverse stress on the critical current of Nb_3Sn cable-in-conduit superconductors, 14:36931 (J;US)
See Strum, M.J., 14:36948
Sundberg, J., Thermal conductivity of rock and soil, 14:36203 (RA;CA;In English and French)
Suponitskij, Yu.L., Thermodynamic properties of alkali metal chalcogenates, chromates, molybdates, and tungstates, 14:36764 (RA;SU;In Russian)
See Papikyan, S.Kh., 14:36761
Surat, L.L., Phase ratios in the system Li_2O-K_2O-NiO-V_2O_5, 14:36801 (RA;SU;In Russian)
Suraud, E., Compressional effects in heavy ion collisions: spinodal decomposition and thermal energy saturation, 14:37608 (R;FR)
Explosions in Landau Vlasov dynamics, 14:37762 (R;FR)
Suslov, I.R., Difference schemes for solving the equation of the discrete ordinate method in the (Δ,Z) geometry, 14:36075 (RA;SU;In Russian)
Susnitzky, D.W., *See* Carter, C.B., 14:36626
Susskind, L., *See* Klebanov, I., 14:37711
Suter, G.W. II, [International workshop on terrestrial field testing of pesticide, Cambridge, United Kingdom, September 11–16, 1988]: Foreign trip report, 14:37335 (R;US)
Sutherland, H.J., Damage predictions for wind turbine components using the LIFE2 computer code, 14:36881 (R;US)
Sutton, S.R., *See* Flynn, G.J., 14:37425
Suz'ko, A.A., *See* Vinitskij, S.I., 14:37705
Suzuki, F., *See* Elgert, B.D., 14:35630
Suzuki, Mitsuhiro, Break location effects on PWR small break LOCA phenomena. Inadequate core cooling in lower plenum break test at LSTF, 14:36156 (R;JP)
Sverdrup, H.U., Mathematical model for podzolic soil profiles exposed to acid deposition, 14:37272 (RA;NO)
Sveum, P., Oil at shore and in deposits. Succesive report 1987, 14:35662 (R;NO;In Norwegian)
Sviridov, A.I., *See* Skorovarov, D.I., 14:36719
Sviridova, R.A., *See* Skorovarov, D.I., 14:36719
Svishchev, V.S., *See* Rabin, A.A., 14:36877
Svistunov, Yu.A., *See* Vladimirova, L.V., 14:37060
Swaid, I., *See* Murtada, H., 14:35604
Swander, A.J., Simulator instructor training - a case of utility teamwork, 14:36041 (RA;US)
Swank, J.H., *See* Panek, R.J., 14:37436
Swanson, J.L., TRUEX process laboratory studies with Hanford complexant concentrate waste: Part 2, Test for solvent poisoning, 14:35806 (R;US)
Sweeney, L.E., GPU's experience with curtailable loads, 14:36309 (RA;US)
Sweeney, M.A., *See* Rochau, G.E., 14:37774
Swenson, C.A., A compact x-ray lithography lattice using superferric magnets, 14:37034 (R;US)
Swift, W.M., *See* Natesan, K., 14:36357
Swihart, J.C., Transport in metal alloys and resistivity saturation, 14:37695 (BA;US)
Swindeman, R.W., Relaxation response of A533B steel from 25 to 600°C, 14:36474 (R;US)
Swinnea, J.S., *See* Persad, C., 14:36611
Swinton, M.C., *See* Haysam, J.C., 14:37024
See Haysom, J.C., 14:37025
Sword, M.A., *See* Garrett, H.E., 14:35901
Sworski, T.J., *See* Marshall, B.B., 14:37121
Sykes, A., *See* Littlechild, S., 14:36271
Syphers, M.J., *See* Hanft, R.W., 14:36921
See Herrup, D.A., 14:36920
Szaro, S., Ionization chamber-detecting setup of Vasilisa installation for the study of characteristics of total fusion reaction product decay, 14:37115 (R;SU;In Russian)
Szczepanska, J., *See* Witczak, S., 14:35566
Szymanski, J.K., Statistical analysis of collected times between failure and times to repair of Easi-Miner at Obed Mine, 14:35569 (R;CA)

T

Tabet, N., Grain boundary electrical activity of n-type germanium, 14:36532 (BA;FR)
Tackett, J.R., The effect of ultra-high vacuum on thermal ionization processes, 14:37140 (R;US)
Tajima, T., *See* Newberger, B., 14:37049
Takagi, A., *See* Alton, G.D., 14:37467
Takahashi, S., *See* Klosterbuer, S.F., 14:35756
See Menlove, H.O., 14:35757
Takahashi, Y., *See* Ishida, Y., 14:36623
Takasugi, T., Controlling embrittlement at grain boundaries in intermetallic compounds, 14:37676 (BA;FR)
Takata, M., *See* Kitano, Y., 14:37667
Takatsuka, T., Reaction mechanism in VisABC process, 14:35635 (RA;CA)
Takekawa, S., *See* Inoue, Z., 14:36644
Takemasa, H., *See* Matsuda, S., 14:36404
Takeuchi, Hiroshi., *See* Nishino, Nobuhiro, 14:37733
Takeuchi, Kiyoshi, Study on the optimization with shielding design of marine reactor, 14:36038 (R;JP;In Japanese)
Takeuchi, Takayuki, Qualitative and quantitative investigation of trace impurities (about 30 elements) in Si by neutron activation analysis, 14:36722 (RA;JP;In Japanese)
Takigawa, M., ^{17}O NMR study of $YBa_2Cu_3O_{7-\delta}$, 14:36641 (R;US)
See Hammel, P.C., 14:36640
Takigawa, Masashi, Anomalous temperature dependence of Cu NMR line width and magnetization in $YBa_2Cu_3O_{7-\delta}$, 14:36642 (R;US)
Tallon, R.W., Proton backscattering in bulk silicon at large angles of incidence. Final report, 14:36657 (R;US)
Tan, Chung-I, *See* Feldman, D., 14:37493
Tan, M.J., Interfa· ial area measurement methods, 14:36978 (R;US)
Tanaka, S., *See* Hagege, S., 14:36624

Tanasheva, M.R., Physico-chemical study of extraction systems by the method of solubility diagrams, 14:36830 (RA;SU)
Tanczyn, R., *See* Benczer-Koller, N., 14:37590
Tanner, J.E., *See* Scherpelz, R.I., 14:37662
Tanner, L.E., *See* Kamenetzky, E.A., 14:36596
Tanzi, E.G., *See* Treves, A., 14:37431
Tarabrin, Yu.A., *See* Zhil'tsov, V.A., 14:37765
Tardy, H.L., ELLIPSE user's manual and program reference, 14:37811 (R;US)
Tarrer, A.R., *See* Curtis, C.W., 14:35526
See Guin, J.A., 14:35556
Tasker, P.W., *See* Stoneham, A.M., 14:36620
Tatsumi, K., Effect of manganese on intergranular fracture in low alloy steels, 14:36537 (BA;FR)
Tautz, M.F., *See* Morgan, M.A., 14:37785
Taylor, C.E., *See* Gregory, E., 14:36938
See Pope, W.L., 14:36923
Taylor, G.E. Jr., Physiological aspects of deposition of trace gases to leaves, 14:37397 (J;US)
Taylor, T.R., Macroscopic constraints on string unification, 14:37548 (R;US)
Tchurikov, N.A., Concerted transposition in Drosophila melanogaster, 14:37307 (RA;US)
Teagan, P., *See* Windingland, L.M., 14:36252
Teague, M.E., *See* Muzio, L.J., 14:37197
Teji, D.S., Thermal energy storage: An application guide for local governments, 14:36197 (R;US)
Teng Teng, *See* Jiufang Lu, 14:35765
See Yigui Li, 14:36860
TenWolde, A., Thermal properties of wood and wood panel products for use in buildings, 14:36378 (R;US)
Ter-Akopyan, G.M., *See* Szaro, S., 14:37115
Terazawa, Hidezumi., Super-hypernuclei in the quark-shell model, 14:37524 (R;JP)
Terent'ev, M.V., Equipment and methodical complex for measuring integral volumetrical activity of radon and its fission products, 14:37659 (RA;SU;In Russian)
Terry, P.L., A solid state video recorder as a direct replacement of a mechanically driven disc recording device in a security system, 14:37812 (R;US)
Teschendorff, V., ATHLET - an advanced system code for the analysis of thermohydraulic processes, 14:36152 (R;DE;In German)
Tetreault, D.J., Magnetohydrodynamic clump instability, 14:37713 (R;US)
Teufel, L.W., Influence of natural fractures on hydraulic fracture propagation, 14:35634 (B;US)
Tewksbury, T.L., The selective oxidation desulfurization process: bench-scale studies: Final report, 14:35532 (R;US)
Thacher, P.D., Calibration of beam power monitors for laser welding, 14:36970 (BA;US)
Thayer, G.R., Economics of selected energy applications of peat in Panama and Costa Rica, 14:35595 (R;US)
The NA 14 Collaboration, *See* Wormser, G., 14:37543
Thekdi, A.C., *See* Chace, A.S., 14:36412
Theriault, D.J., Hydraulic fracturing improves steam placement and oil recovery, 14:35701 (RA;CA)
Thermal well completions seminar, 14:35722 (R;CA)
Theriot, E.D., *See* Fast, R.W., 14:36925
Thibaud, J.P., *See* Bourgeois, C., 14:37591
Thibault-Desseaux, J., Grain-boundary dislocations structure and movement in Σ=9 studied by HREM, 14:36496 (BA;FR)
See Lancin, M., 14:36630
Thie, J.A., Surveillance of instrumentation channels at nuclear power plants: Volume 2, An approach to classifying problems and solutions: Final report, 14:36095 (R;US)
Thieme, C.L.H., *See* Coffey, K.R., 14:36944
Thiessen, R.L., Comparison of spectral data gathered from a laboratory spectrometer and TM images with and without shadow correction, 14:37404 (R;US)
Thoburn, T.W., Health-hazard evaluation determination report No. 74-78-297, Amax Speciality Metals, Parkersburg, West Virginia, 14:37185 (R;US)
Thomas, A.H., *See* Lederer, C.C., 14:36254
Thomas, B.J., *See* Rothstein, R.J., 14:37293
Thomas, E.L., *See* Wignall, G.D., 14:36680
Thomas, G., *See* Green, S.M., 14:36953
See Ho, H.M., 14:36685
Thomas, R.A., *See* Zentler, J.M., 14:37046
Thomas, R.L., *See* Bronson, M.C., 14:35758
Thomas, W., *See* Cockshutt, D., 14:35723
Thome, M., *See* Reim, K., 14:35752
Thompson, J.D., *See* Ott, K.C., 14:36639
See Takigawa, M., 14:36641
See Takigawa, Masashi, 14:36642
Thompson, J.R., *See* Christen, D.K., 14:36952
See Sekula, S.T., 14:36949
Thompson, R.C., Life-span effects of ionizing radiation in the beagle dog: A summary account of four decades of research funded by the US Department of Energy and its predecessor agencies, 14:37383 (R;US)
Thompson, R.G., Grain boundary chemistry contributions to intergranular hot cracking, 14:36513 (BA;FR)
Thompson, W.M., An architecture for real-time control and data acquisition at LLNL's high explosives application facility (HEAF), 14:37153 (R;US)
Thorel, A., Atomic structure of vitreous interfacial films in sialon, 14:36671 (BA;FR)
Thorlacius, L., *See* Callan, C.G., 14:37559
Thorstenson, Y.R., *See* Martin, B., 14:37396
Thurman, J.M., Tank farm surveillance and waste status summary report for April 1989, 14:35813 (R;US)
Tichelaar, F.D., TEM determination of incoherent twin-boundary structure in $L1_2$ ordered alloys, 14:36497 (BA;FR)
Tierney, S.F., Regulatory perspective on interruptible rates, 14:36312 (RA;US)
Tietz, L.A., *See* Carter, C.B., 14:36626
Tikhonova, A.I., *See* Ramzaev, P.V., 14:37646
Tiller, W.A., *See* Hahn, S., 14:36694
Tilles, D., *See* O'Meara, J., 14:36942
Tilley, B., Thermal environment evaluation, 14:36394 (R;CA;In French and English)
Tills, J.L., *See* Williams, D.C., 14:36189
Tilton, L.M., *See* Bonano, E.J., 14:35792
Ting, L., *See* Siegel, R.W., 14:36534
Tingate, G.A., HIFAR commissioning and operation 1955-1962, 14:36121 (RA;AU)
Tipikin, V.N., *See* Kebadze, B.V., 14:37136
Tipton, T.E., Industry activities on operator requalification, 14:36043 (RA;US)
Titus, S.J., Theory and methodology of single tree volume estimation, 14:35907 (R;CA;In English and French)
Tkachev, M.V., *See* Bejder, B.D., 14:36563
Tnieme, C.L.H., *See* Pourrahimi, S., 14:36941
Toburen, L.H., Radial distributions of energy deposited along charged particle tracks, 14:37663 (R;US)
Toeda, S., *See* Noji, K., 14:35986
Toge, N., Recent commissioning experience on the SLC Arcs, 14:37095 (R;US)
Toi, K., Plasma current startup by lower hybrid waves in the JIPP T-IIU tokamak, 14:37730 (R;JP)
Tokiwa, Y., *See* Appel, B.R., 14:37188
Tollefson, E.L., *See* Sengupta, S., 14:35716
Tollestrup, A.V., *See* Herrup, D.A., 14:36920
See Kuchnir, M., 14:36932
Tollin, J., Heat pump with a hard rock well equipped for thermal recharging, 14:35931 (RA;CA;In English and French)
Tolstov, K.D., *See* Krasnov, S.A., 14:37598
Toma, P., Optimization of heavy oil thermorecovery made possible with a novel in-situ process, 14:35715 (RA;CA)
Tomita, Kenji., *See* Sasaki, Misao, 14:37442
Tomljanovich, D.A., Results of fisheries investigations in Douglas tailwater, August 1987–September 1988, 14:35897 (R;US)
Tompkins, P.A., An optimized H^- magnetron ion source/lebt system, 14:37073 (R;US)
Toney, M.F., *See* Kortright, J.B., 14:36854
Tooper, F.E., Fission product behaviour during the TMI-2 accident, 14:36190 (BA;US)
Topor-Pop, R., *See* Besliu, C., 14:37519

Topor-Pop, V., *See* Besliu, C., 14:37519
Toquam, J., *See* Moore, C., 14:36162
Torak, E.R., *See* Arnold, B.J., 14:35512
Torata, Shin-ichiro, Development of glass melter for the PNC Tokai Vitrification Facility, 14:35800 (R;JP)
Torgov, V.G., Acceptor extraction of uranyl salts with mixtures of organophosphoric acids with neutral additives, 14:36863 (RA;SU)
Toth, L.M., The aqueous chemistry of iodine, 14:36856 (BA;US)
Toth, M., *See* Spilrain, E.E., 14:35605
Toth, R.P., *See* Bacon, L.D., 14:37015
Tramutola, T., Two-part pricing in real-time, 14:36303 (RA;US)
Travnikova, I.G., *See* Poplavskij, K.K., 14:37650
Treece, R.K., *See* Hass, K.J., 14:37130
Tremoulilles, G., TEM study of ZrO_2/Al interface, 14:36629 (BA;FR)
Trent, B.C., Numerical simulation of the simultaneous detonation of two identical, fully contained explosions, 14:37151 (R;US)
Treves, A., Far UV observations of black hole candidates: the case of LMC X-3, 14:37431 (RA;FR)
Tribble, M.J., *See* Norris, J.O.W., 14:37128
Tribula, D., Observations on the mechanisms of fatigue in eutectic Pb-Sn solder joints, 14:36574 (R;US)
Trinh, K.V., Nonlinear dynamic response of pressurized composite bottles subjected to shock loading, 14:36885 (R;US)
See LaJeunesse, C.A., 14:36884
Tripathy, S., *See* Samuelson, L., 14:36659
Trocki, L.K., An economic prefeasibility study of geothermal energy development at Platonares, Honduras, 14:35940 (R;US)
Troitskaya, M.N., New aspects in studying the effect of low dose ionizing radiations, 14:37370 (RA;SU;In Russian)
Troyan, Y.A., *See* Arakelian, S.G., 14:37520, 14:37521
Truett, T., Electronic communication and data transfer productivity enhancements, 14:37800 (R;US)
Trujillo, A.A., Demonstrations of a real time personnel and material tracking system, 14:37791 (R;US)
See Schumann, M., 14:37790
Trukhanov, G.Ya., DEMETRA-ES program, 14:36080 (RA;SU;In Russian)
Truscott, P.R., *See* Dyer, C.S., 14:37129
Trybus, C.L., Preparation of in situ Cu-Nb composite sheet and wire for TEM analysis, 14:36599 (BA;US)
Tsai, C.H., *See* Bunger, J.W., 14:35706
Tsai, M.Y., *See* Wood, J.D., 14:36586
Tsakalakos, T., Special mechanical properties of very thin films, 14:36538 (BA;FR)
Tse, D.S., *See* Hirschon, A.S., 14:35527
See McMillen, D.F., 14:35521, 14:35531
Tsertos, H., Search for resonant Bhabha scattering at MeV energies, 14:37507 (R;DE)
Tsirikhova, N.Kh., On the interaction of cesium nitrate with zinc nitrate in saturated aqueous solution at 298 K, 14:36794 (RA;SU;In Russian)
Tsong, I.S., *See* Wilson, I.H., 14:36656
Tsuda, Kenzo, *See* Matsuura, Kiyokata, 14:37804
Tsunoda, Naomi, *See* Torata, Shin-ichiro, 14:35800
Tsuyuzaki, Noriyoshi, *See* Baba, Osamu, 14:36021
Tsvetkov, A.A., *See* Yakimova, E.E., 14:36710
Tsvineva, G.P., *See* Kulikov, M.V., 14:37086
Tuecke, S., *See* Butler, R., 14:37285
Tulenko, J., *See* Wehe, D.K., 14:37816
Turala, M., *See* Adolphsen, C., 14:37096
Turchi, P.J., *See* Cochrane, J.C., 14:37686
See Goforth, J.H., 14:37734
Turcotte, R.P., Phase relationships in high-temperature ceramics. Phase 1. Final report, 14:36610 (R;US)
Turenne, S., *See* Mirza, J., 14:36679
Turlejski, S., *See* Dytczak, M., 14:35934
Turman, B.N., Interstage closure times for the rimfire multistage gas switch, 14:37773 (R;US)
See Warren, F.T., 14:36882
Turner, D.H., Molecular basis of RNA catalysis. Annual report, March 1988-February 1989, 14:37301 (R;US)
Turner, L., Radiative collapse of a Bennett-relaxed z-pinch, 14:37736 (R;US)
Turner, M.G., *See* Gardner, R.H., 14:37211
Turner, M.S., Windows on the axion, 14:37517 (R;US)
Turvey, F.J., *See* O'Donovan, N., 14:35788
Tuzel, W., A superconducting cos 2θ quadrupole design for the CEBAF high resolution spectrometer, 14:36937 (J;US)
See Alcorn, J., 14:36943
See Harwood, L.H., 14:36939
See O'Meara, J., 14:36942
Tyson, T.J., *See* LaFond, J.F., 14:35591
Tzanos, C.P., A central difference type approximation of convection in fluid flow, 14:36977 (R;US)

U

Ubhayakar, S.K., *See* Grove, A., 14:36360
Uchida, Masaaki, *See* Muramatsu, Ken, 14:35993
Udseth, H.R., The on-line combination of capillary isotachophoresis with mass spectrometry, 14:37142 (R;US)
See Loo, J.A., 14:36846, 14:37141
See Smith, R.D., 14:37143, 14:37475
Ueno, A., *See* Alton, G.D., 14:37467
Ufaev, N.N., Calculational method for individual pipeline tracing in channel nuclear reactors, 14:36018 (RA;SU;In Russian)
Ul'anov, V.S., *See* Skorovarov, D.I., 14:36719
Ul'yanov, V.S., *See* Skorovarov, D.I., 14:36864
Ulpat, J.P., *See* Vergnaud, T., 14:37156
Unger, E.W., *See* Chace, A.S., 14:36412
Updegraff, C.D., *See* Bonano, E.J., 14:35792
Urban, J., *See* Sandor, L., 14:37508
Urbina, C., *See* Wellstood, F.C., 14:36903
Urdaneta, O., *See* Chacin, E., 14:35617
Us, T.V., *See* Torgov, V.G., 14:36863
Utkina, O.V., *See* Danilov, N.A., 14:36842

V

Vaglio, R., *See* Romano, P., 14:36956
Vajdi, L.E., *See* Allen, D.T., 14:35558
Vajsfel'd, M.I., *See* Shevchuk, V.G., 14:36780
Vakhrushin, Yu.P., Results of experimental investigation of injector part of the LIU-30 accelerator, 14:37087 (R;SU;In Russian)
See Bystrov, V.M., 14:37080
Val'dner, O.A., 1 MeV proton accelerator, 14:37038 (RA;SU;In Russian)
Valbis, Ya.A., Cross-luminescence is a method of rare earth element electron structure investigation and physical base for subnanosecond scintillator operation, 14:37680 (RA;SU;In Russian)
Valentin, E., *See* Combe, J., 14:35611
Valentine, G.A., *See* Wohletz, K.H., 14:37410
Valougeorgis, D., Boundary treatment of the diffusion synthetic acceleration method for fixed-source discrete-ordinates problems in x-y geometry, 14:36081 (J;US)
Van de Wiele, J., *See* Langevin-Joliot, H., 14:37588
Van Den Avyle, M.J., *See* Hill, J., 14:37249
van den Berg, J.M., Cogeneration in Europe, 14:36250 (RA;US)
Van Eeckhout, E., Central American resource studies, 14:36236 (R;US)
Van Houten, N.C., US Department of Energy radioisotope customers with summary of radioisotope shipments, FY 1988, 14:35856 (R;US)
van Mourik, G.J., Heat storage R&D in The Netherlands, 14:36243 (RA;CA;In English and French)
Van Scoy, R.J., High-performance, intrinsically safe data-acquisition system for underground use. Final report, October 1984-December 1984, 14:35575 (R;US)
Van Siclen, V.S., *See* Sattison, M.B., 14:36174
Van Vuuren, D.S., Assessment of the techno-economic potential of Fischer-Tropsch slurry reactors, 14:35543 (R;ZA)
VanArsdale, R., Post-Pennsylvanian reactivation along the Washita Valley fault, southern Oklahoma, 14:37411 (R;US)
Vanderlaan, J.F., DIII-D power supply fault system, 14:37761 (R;US)
VanDerSande, J.B., *See* Kelly, T.F., 14:36600

VanDevender, J.P., Status of light ion approach inertial confinement fusion, 14:37779 (R;US)
VanDuzer, T., *See* Chin, D.K., 14:36899
Vanin, V., *See* Mikhajlov, I.N., 14:37631
Varin, R.A., *See* Ruutopold, A., 14:36495
Varnek, A.A., Electron structure and electrostatic potential of some neutral organophosphorus extractants and their complexes, 14:36818 (RA;SU)
Varsamis, G., Neutronics analysis for aqueous self-cooled fusion reactor blankets, 14:37756 (R;CA)
Vashishta, P., *See* Feuston, B.P., 14:37691
Vashman, A.A., Mechanism of nitric acid and strontium extraction with zirconium di-2-ethylhexyl phosphate complexes-studying by the ^{14}N and ^{31}P NMR methods, 14:36837 (RA;SU)
Vasil'eva, Eh.V., *See* Boneva, S.T., 14:37633
Vasilevich, A.A., *See* Korabel'nikova, L.M., 14:36812
Vaudin, M.D., Electron microscopy studies of diffusion-induced grain boundary migration in ceramics, 14:36535 (BA;FR)
See Handwerker, C.A., 14:36631
See MacKenzie, R.A.D., 14:36492
Vaughan, J.D., *See* Lenz, T.G., 14:36739
Vaughan, K.H., Conservation and Renewable Energy Program bibliography, 1989 Edition, 14:36370 (R;US)
Vdovin, S.A., Plasma storage in the Yupiter-2M multislit electromagnetic trap, 14:37722 (RA;SU;In Russian)
Vecsey, G., *See* Zichy, J.A., 14:36915
Vega, L., Trial-Burn Observation Guide. Final report, 14:36438 (R;US)
Vegh, P., *See* Culea, M, 14:37469
Veidal, A., *See* Norton, S.A., 14:37266
Velikhov, E.P., Thermonuclear synthesis. Scientific-technical collection, 14:37712 (R;SU;In Russian)
Velikodnyj, Yu.A., *See* Belov, V.V., 14:36776
Velsko, S.P., *See* Davis, L.E., 14:37781
Vendel, J., *See* Pourprix, M., 14:35835
Venturini, E.L., Annealing and strain effects on Tl-Ba-Ca-Cu-O crystals and ceramics, 14:36647 (R;US)
Diamagnetic shielding and flux creep in a Tl-Ba-Ca-Cu-O thin film, 14:36584 (R;US)
Vergnaud, T., Neutrons and gamma transport in atmosphere by Tripoli-2 code. Energy deposit and electron current time function, 14:37156 (R;FR;In French)
Verho, E., *See* Bucurescu, D., 14:37624
Verhoeven, J.D., *See* No, K., 14:36947
Verma, A., *See* Farouq Ali, S.M., 14:35714
Vernazza, J.E., *See* Vogtlin, G.E., 14:37019
Vesely, E., *See* Batt, D.L., 14:36053
Vetokhov, V.M., *See* Amosov, I.I., 14:37081
Vicens, J., Structural analysis and properties of grain boundaries in hexagonal carbides, 14:36628 (BA;FR)
Viecelli, J.A., *See* Chambers, D.H., 14:37486
Vigdorchik, A.G., *See* Shevchuk, V.G., 14:36781
Vigneault, C., Ice production using ambient winter temperatures, 14:36205 (RA;CA;In English and French)
Precooling vegetables using a block of ice produced by winter coolness., 14:36415 (RA;CA;In English and French)
Viljoen, J., *See* Balint, A.B., 14:37641
Villarroel, H.S., *See* Gouveia, A.H.C., 14:36708
Vineyard, E.A., *See* Sand, J.R., 14:36387
Vinitskij, S.I., Adiabatic representation of scattering problem in three-body quantum system, 14:37705 (R;SU;In Russian)
Vinjamuri, K., TMI-2 leadscrew radionuclide deposition and characterization, 14:36192 (BA;US)
Visinescu, A., *See* Grecu, D., 14:37550
Vislenko, O.V., *See* Strel'nikova, N.K., 14:37361
Visser, A.T., *See* du Plessis, H.W., 14:36406
Visser, M., Quantum mechanical stabilization of Minkowski signature wormholes, 14:37708 (R;US)
Vitek, V., Molecular statics studies of grain boundaries: structure and energy of (001) twist boundaries, 14:37665 (BA;FR)
Vivien, J.P., Neutron emission and nuclear spin distribution in 4n and 5n exit channels of the ^{156}Dy compound nucleus, 14:37586 (R;FR)
Vladimirova, L.V., Optimization of particle dynamics in accelerating installation with account of the excitation of resonator by a beam, 14:37060 (RA;SU;In Russian)
Voevodina, T.M., *See* Kulikova, S.B., 14:37357
Voggenberger, T., *See* Beraha, D., 14:36153
Vogtlin, G.E., Vacuum insulator failure measurements and improvement, 14:37019 (R;US)
See Zentler, J.M., 14:37046
Volkov, A.I., Thermodynamic and crystallochemical features of thermal dehydration process of rubidium and cesium dihydroorthophosphates, 14:36757 (RA;SU;In Russian)
Volkov, V.L., *See* Golovkin, B.G., 14:36777
See Maksimova, L.G., 14:36768
Volynkina, A.Ya., *See* Mikheeva, T.M., 14:36815
Volzhev, A.A., *See* Vakhrushin, Yu.P., 14:37087
von Bernuth, R.D., *See* Hoffman, F.O., 14:37203
Von Dreele, R.B., Modeling of non-structural contribution to the pattern, 14:37685 (R;US)
von Frankenberg, R., *See* Barnes, P.D., 14:37503
von Goeler, S., *See* Beiersdorfer, P., 14:37738
Von Wimmersperg, U., Observation of a deviation from Bhabha scattering in the electron-positron system, 14:37622 (RA;ZA)
Vorb'ev, V.P., *See* Gorobunov, V.P., 14:36105
Voropaev, S.G., Generator of a high-power microsecond REB, 14:37721 (RA;SU;In Russian)
Voroshilov, Yu.V., *See* Semrad, E.E., 14:36772
Vorotyntsev, M.F., *See* Sataev, E.A., 14:36073
Vorozhtsov, S.B., Hardware and software complex for cyclotron beam dynamics simulation, 14:37062 (R;SU;In Russian)
Vorthman, J.E., A battery-powered flux compression generator system, 14:37008 (R;US)
See Reinovsky, R.E., 14:37005
See Rickel, D.G., 14:37011
Voruganti, P., Stable static solitons in the nonlinear sigma model with a topological term, 14:37558 (J;NL)
Voslamber, D., Determination of magnetic field direction in tokamaks from laser-induced Lyman-α fluorescence, 14:37717 (R;FR)
Voss, S.H., *See* McDonald, J.F., 14:37312
Voter, A.F., *See* Chen, S.P., 14:36488
Vovk, E.A., *See* Lazoryak, V.I., 14:36756
Voycik, J.J., Utilization potential of coal-combustion by-products: Somerset Power Plant case study. Final report, 14:36418 (R;US)
Vries, W. de., Conceptual model for analysing soil and groundwater acidification on regional scale. International symposium on acidification and water pathways, 14:37239 (RA;NO)

W

Wada, Y., *See* Takatsuka, T., 14:35635
Wade, R., *See* Starrfield, S., 14:37437
Waganaar, W.J., *See* Rej, D.J., 14:37771
Wagner, D.K., *See* Cho, N.H., 14:36670
Wagner, J.S., BUCKSHOT simulations of beam injection on the recirculating linac, 14:37093 (R;US)
Wagner, R.G., *See* Gabutti, A., 14:37123
Wagner, R.M., *See* Starrfield, S., 14:37437
Wagner, S., *See* Srinivasan, S., 14:36223
Wahi, K.K., *See* Bonano, E.J., 14:35792
Walcott, K., *See* Beninga, K., 14:35926
Wald, L.L., *See* Fan, N.Q., 14:36905
Wales, D.L., Preliminary assessment of the current impact and potential risk of acidic deposition on walleye populations in Ontario, 14:37392 (R;CA)
Walker, J.K., *See* Womersley, W.J., 14:37122
Walker, N., Statistics on smoke and sulfur dioxide pollution in South Africa. Special report, 14:37187 (R;ZA)
Walker, S., *See* Jordan, S.E., 14:35847
Walkowiak, W., Ionizable polyethers as specific metal ion carriers in liquid-liquid extraction and liquid membrane separations, 14:36834 (RA;SU)
Wall, M., *See* Kamenetzky, E.A., 14:36596
Wall, T.J., Annual critique: an effective program evaluation tool, 14:36139 (RA;US)

Wallace, R., *See* Slavik, J.N., 14:35741
Wallis, J.W. Jr., *See* Rothstein, R.J., 14:37293
Wallner, H., *See* Neugebauer, H.J., 14:35598
Wallo, A. III, *See* Yu, C., 14:35823
Walsh, D.S., External ion beam analysis of the TFTR [Tokamak Fusion Test Reactor] bumper limiters, 14:37777 (R;US)
Walsh, M.P., Program to assure good in-use vehicle emissions performance in the Federal Republic of Germany through improved compliance with standards. Final report, 14:36449 (R;DE;In German)
Walsh, R.L., *See* Hinde, D.J., 14:37607
Walther, R.J., Assessing the value of service reliability, 14:36292 (RA;US)
Walukiewicz, W., Fermi level stabilization in semiconductors, 14:36698 (BA;US)
See Nolte, D.D., 14:36697
Wampler, W.R., *See* Myers, S.M., 14:36606
Wamsteker, W., *See* Sanz Fernandez de Cordoba, L., 14:37429
Wanderer, P., Test results from recent 1.8-M SSC model dipoles, 14:36908 (J;US)
Wands, R.H., *See* Fast, R.W., 14:36925
Wang, Tai-Sen, Unbunched beam electron-proton instability in the PSR and advanced hadron facilities, 14:37063 (R;US)
Wang, X., Theoretical investigations of phonon anomalies in fcc La and W(001), 14:36603 (D;US)
Wano, Y., *See* Greene, W.C., 14:37329
Ward, C., *See* VanArsdale, R., 14:37411
Ward, K.J., Quantitative infrared spectroscopy of glucose in blood using partial least-squares analyses, 14:37300 (R;US)
Ward, R.L., *See* Gunter, R., 14:37023
Warde, C., Thin-film optics for signal-processing applications. Final report, 1 September 1986-31 May 1988, 14:36999 (R;US)
Ware, A.G., A review of recent developments in pipe damping allowable values for United States nuclear plants, 14:35990 (R;US)
Aging degradation of BWR feedwater and main steam lines, 14:35989 (R;US)
Results of the initial phase of the INEL/USNRC large bore hydraulic snubber reliability evaluation program, 14:36144 (R;US)
Warfvinge, P.G., *See* Sverdrup, H.U., 14:37272
Warpinski, N.R., *See* Teufel, L.W., 14:35634
Warren, F.T., Jitter improvement of the 12-MV oil switches on Aurora, 14:36882 (R;US)
Watanabe, T., Grain boundary design for desirable mechanical properties, 14:37674 (BA;FR)
Waters, A.E., *See* Hoffman, F.O., 14:37203
Wathne, B.M., *See* Norton, S.A., 14:37266
Watson, J. W., ^{7}Li(p,n)^{7}Be and ^{12}C(p,n)^{12}N reactions at 200, 300, and 400 MeV, 14:37579 (J;US)
Watson, J.S., Electrically stabilized expanded beds for sorption separations, 14:36706 (R;US)
Watson, K., Cellular stress induced by UV-radiation and hyperthermia - a common mechanism, 14:37353 (RA;AU)
Watterson, J.I.W., *See* Lycoudi, M., 14:35852
Watts, M.F., *See* Barrett, J.H., 14:37100
Wauters, P., *See* Charlier, M., 14:35937
Waylett, W.J. Jr., Training management systems - a comparison, 14:36055 (RA;US)
Webb, J., Samarium 153 chelate localization in malignant melanoma, 14:37348 (RA;AU)
Webb, M.L., *See* Fields, D.J., 14:37600
Webber, R.T., *See* Averill, D.W., 14:35787
Weber, E.R., *See* Li, M.F., 14:36699
Weertman, J., *See* Menyhard, M., 14:36510
Wehe, D.K., Intelligent robotics and remot systems for the nuclear industry, 14:37816 (J;NL)
Weiner, E.O., Thermo-plastic analysis of a bowed sodium pump shaft, 14:36035 (R;US)
Weiner, R.M., *See* Carruthers, P., 14:37540
Weingarten, L.I., *See* Trinh, K.V., 14:36885
Weinstein, B., *See* Kang, M., 14:36963
Weinstein, I.B., Possible role of retrotransposons in carcinogenesis, 14:37389 (RA;US)
Weirauch, D.A. Jr., Phase equilibria and interfacial phenomena in the Mg-Al-O system at 800°C, 14:36500 (BA;FR)
Weirich, J.B., Gravel pack equipment requires special design for thermal recovery, 14:35626 (RA;CA)
Weiss, B., Low-spin states in ^{122}Cs, 14:37589 (R;FR)
See Genevey, J., 14:37581
Weiss, D.L., *See* Greene, A.E., 14:37003
See Parker, J.V., 14:37481
Weiss, H., Coking of oil sand, asphaltenes and residual oils in the LR-process, 14:35705 (RA;CA)
Welland, J.D., *See* Allen, B.L., 14:36229
Wellman, G.W., Specimen thickness effects for elastic-plastic CTOD toughness of an A36 steel, 14:36602 (BA;US)
Wells, J.E., Seismic risk of a BWR, 14:36171 (BA;DE)
Wellstood, F.C., Hot electron effect in the dc SQUID, 14:36903 (J;US)
See Ferrari, M.J., 14:36897
Wender, I., *See* Cugini, A.V., 14:35546
Wendling, P., *See* Hodgdon, M.L., 14:37480
Wenger, L.E., *See* Cheng, J.T., 14:36609
Wentzel, H.U., *See* Jost, J., 14:36414
Wenz, W., *See* Bruecher, K., 14:35589
Weppling. K., *See* Bjoerkqvist, D., 14:37247
Werden, B., *See* Dressler, K., 14:36991
Werth, F.J., *See* Qi, J., 14:35645
Wesely, M.L., Report on Working Group deliberations: Water quality group, 14:37215 (R;US)
Weseman, M., *See* McCauley, W., 14:35826
Wessels, B.W., *See* Sammells, A.F., 14:35861
Wetzel, R.G., *See* Burkholder, J.M., 14:37252
Whaley, H., *See* Banks, G.N., 14:35588
Wharton, J.B., Rate manager's perespective: theory to practice, 14:36308 (RA;US)
Rate manager's perspective: theory to practice, 14:36285 (RA;US)
Wheater, H.S., *See* Langan, S.J., 14:37261
Whirley, R.G., *See* Hallquist, J.O., 14:36893
White, A., Transferring generic SARA/OSHA training to US Department of Energy facilities, 14:35825 (RA;US)
White, A.F., Surface reactions of natural glasses, 14:35821 (BA;US)
White, B.A., Potential supply of minerals from the White Mountains National Recreation Area and Part of the North Steese National Conservation Area Alaska. Appendix A- potential mineral supply analysis methodology, 14:36237 (R;US)
White, C.M., *See* Perry, M.B., 14:35560
White, C.W., *See* Sklad, P.S., 14:36618
White, J.D., Overview of the US program of controls for advanced reactors, 14:36027 (R;US)
White, J.H., *See* Haysam, J.C., 14:37024
See Haysom, J.C., 14:37025
White, J.S., *See* Scheeline, A., 14:37746
White, R.C., *See* Ho, P.S., 14:36668
Whitehead, L., Large scale illumination using prism light guide and a Vortek lamp, 14:36399 (R;CA)
Whitehead, P.G., Modelling long term stream acidification trends in upland Wales, 14:37271 (RA;NO)
Whiteman, C.D., *See* Gudiksen, P.H., 14:37164
Whitney, R.R., *See* Gross, F., 14:37031
Whittaker, B., *See* Barrett, J.H., 14:37100
Whittle, L., *See* Averill, D.W., 14:35787
Whitus, B.R., Bristol Babcock DPC 3330 controller evaluation, 14:36417 (R;US)
Wichner, R.P., *See* Norwood, K.S., 14:36184
Wicks, J., Pros and cons of negotiated rates, 14:36290 (RA;US)
Widen, W.C., Changing organizational cultures - creating quality achievers through training and teamwork, 14:36136 (RA;US)
Widgoff, M., Progress report of a research program in experimental high energy physics: Task B: Progress report, January 1–December 31, 1989, 14:37501 (R;US)
Wiedenhelt, C.J., *See* Tackett, J.R., 14:37140
Wiemann, D.K., *See* McKay, P.F., 14:37776
Wieringa, D., *See* Moore, C., 14:36162
Wieting, J., Effects of air pollutants on groundwater quality in the Federal Republic of Germany, 14:37241 (RA;NO)
Wiggin, N.A., Managing the training function, 14:36003 (RA;US)
Wightman .M., *See* Keith, D.A.W, 14:35694
Wightman, D.M., *See* MacGillivray, J.R., 14:35699

Wignall, G.D., Scattering, deformation, and fracture in polymers, 14:36680 (B;US)
Wikander, G.R., *See* Kellner, J., 14:36374
Wild, A., Micro-computer fault tree program as a tool for defining problems, 14:35976 (RA;XA)
Wildung, R.E., *See* Cataldo, D.A., 14:37233
Wilen, P., Development of heat storage systems with vertical pipes in earth and rock, 14:36207 (RA;CA;In English and French)
Wiley, C.L., *See* Merkle, K.L., 14:36627
Wilkerson, G., *See* Moore, T., 14:35742
Wilkes, K.E., *See* Cook, J.C. Jr., 14:36375
Wilkes, R., *See* Dickinson, W., 14:35625
Wilkins, D.A., Unique completion practices in a horizontal well, 14:35679 (RA;CA)
Willenborg, D.L., *See* Rosencwaig, A., 14:36616
Willey, R.J., *See* Addison, J., 14:37190
Williams, A.R., *See* Panter, H.C., 14:37354
Williams, C., *See* Szymanski, J.K., 14:35569
Williams, D.C., Phenomenological uncertainties in the suspended radionuclide concentrations in containment during severe LWR accidents, 14:36189 (BA;US)
See Spulak, R.G. Jr., 14:36195
Williams, J.H., Ionising radiation and its application to biotechnology, 14:37349 (RA;AU)
Williams, J.S., Design of an advanced entry control system, 14:36886 (R;US)
Williams, K.A., ORMONTE: An uncertainty analysis code for use with user-developed systems models on mainframe or personal computers: A user's guide, 14:37808 (R;US)
Williams, P.G., *See* Morimoto, H., 14:36845
Williams, R., *See* Selby, G., 14:35992
Williams, R.E., *See* Starrfield, S., 14:37437
Williams, T.M., *See* Norton, R.E., 14:36061
Williamson, C., *See* Gross, F., 14:37567
Williamson, D.A., *See* Duncan, D.A., 14:35895
Williamson, R.L., *See* Jellison, J.L., 14:36583
Williamson, V.M., *See* Paquin, C.E., 14:37295
Willich, N., *See* Schreiber, G.A., 14:37376
Willig, R.D., Competitive pricing and regulatory reform, 14:36282 (RA;US)
Willis, A., *See* Marty, N., 14:37630
Willis, D., *See* Huffman, D.D., 14:37017
Willis, J.O., *See* Maley, M.P., 14:36945
See Ott, K.C., 14:36639
Wills, J.J., *See* Stempvoort, D.R. van, 14:37237
Wilson, A.G., *See* Haysam, J.C., 14:37024
See Haysom, J.C., 14:37025
Wilson, C.T., *See* Lue, J.W., 14:36929
Wilson, I.H., Scanning tunneling microscopy of an ion-bombarded PbS(001) surface, 14:36656 (R;US)
Wilson, M.C., Regulation of expression and transposition of murine endogenous retroviral elements, 14:37292 (RA;US)
Wilson, R., *See* Goodman, M.S., 14:37124
See Moore, C., 14:36162
Winblad, A., *See* Jordan, S.E., 14:35847
Windingland, L.M., Technology selection criteria and methodology for prioritizing energy research and development programs. Final report, 14:36252 (R;US)
Windle, R.J., *See* Caves, D.W., 14:36314
Winston, F., Genes that affect Ty-mediated gene expression in yeast, 14:37309 (RA;US)
Wintenberg, R.E., *See* Lue, J.W., 14:36929
Wipf, S.L., *See* Maix, R.K., 14:36919
Wise, M.B., *See* Grinstein, B., 14:37538
Witczak, S., Acidification of infiltration waters as a result of the seepage through carboniferous host-rocks, 14:35566 (RA;NO)
Witkin, E.M., SOS mutagenesis and replisome reactivation in bacteria: options acquired by transposition?, 14:37340 (RA;US)
Witlox, H.W.M., HEGADAS: heavy gas dispersion program. User's guide, 14:37178 (R;GB)
Witt, B.C. de, *See* Webb, J., 14:37348
Wittberg, T.N., *See* Barton, B.D., 14:37688
Witte, M.C., A structural evaluation of the Shippingport reactor pressure vessel for transport impact conditions, 14:36014 (R;US)
See Mok, G.C., 14:36894
Wohletz, K.H., Computer simulations of explosive volcanic eruptions, 14:37410 (R;US)
Wolf, D., Computer simulation of special grain boundaries in metals and ionic materials, 14:37692 (BA;US)
See Lutsko, J.F., 14:36499
See Nguyen, T., 14:37672
See Phillpot, S.R., 14:36476
Wolf, G.K., *See* Froeschen, W., 14:35789
Wolf, S.A., *See* Kresin, V.Z., 14:36654
Wolfenbarger, F.M., Standard terminal panel and UPS [uninterruptible power supply] design for exterior intrusion detectors and data collection applications, 14:37018 (R;US)
Wolfert, K., Large-scale experiments and their significance for development and verification of thermal hydraulics computer codes, 14:36151 (R;DE;In German)
Wolters, J., *See* Bongartz, R., 14:36157
Womersley, W.J., Erratum to "hadron showers in a low-density fine-grained flash chamber calorimeter", 14:37122 (J;NL)
Wondrak, W., Radiation damages in silicon induced by highly energetic electrons and protons, 14:36676 (R;DE;In German)
Wong, A., Analysis of thermal well pumping performance at the Norcen-Bodo steam pilot, 14:35624 (RA;CA)
Proceedings of the workshop on aspen pulp, paper and chemicals, 14:35900 (R;CA)
Wong, J., *See* Gregory, E., 14:36938
Wong, J.K.L., *See* Banks, G.N., 14:35588
Wong, K., *See* Stasko, R., 14:37757
Wong, T.L., *See* Ruiz, C.P., 14:35991
Wood, D.F., *See* Laing, J.M., 14:35720
Wood, J.A., *See* Averill, D.W., 14:35787
Wood, J.D., Thermal strains in a bimaterial joint: Experimental and numerical analysis, 14:36586 (R;US)
Woodroffe, J.A., *See* Hemsath, K.H., 14:36419
Woodruff, E.M., *See* Kennedy, C.R., 14:36663
Woodruff, M.G., *See* Keller, J.F., 14:35801
Woods, C., *See* Raymond, T.D., 14:36972
Woodward, C.A., *See* Davison, B.H., 14:35519
Woodworth, J.R., *See* Stinnett, R.W., 14:37780
Worcester, P., *See* Briles, S.D., 14:37137
Worledge, D.H., Research in operations: operator reliability experiments, 14:36133 (RA;US)
Wormser, G., Tests of QCD in photoproduction, 14:37543 (R;FR)
Wright, B.W., *See* Smith, R.D., 14:35644
Wright, C., DRI (Data Resources Inc.) Energy Model/GRI (Gas Research Institute) Hydrocarbon Model and IFCAM linkage. Final report, December 1984, 14:36268 (R;US)
See Yanchar, J., 14:36263, 14:36266
Wright, I.G., [2nd international symposium on high-temperature corrosion of advanced materials and coatings, Les Embiez, France, and visit to Manchester, England, May 19–27, 1989]: Foreign trip report, 14:35536 (R;US)
Wright, L.J., An evaluation of the polyester/polyethylene badge packet as an identification card, 14:37792 (R;US)
Wright, R.E., *See* Fisher, J.E., 14:36181
Wrobel, T.F., *See* Huffman, D.D., 14:37017
Wroblowa, H., *See* Srinivasan, S., 14:36223
Wronski, Z., *See* Ruutopold, A., 14:36495
Wu, C.C., *See* Panek, R.J., 14:37436
Wu, F.S., *See* Sankey, B.M., 14:35713
Wuebbles, D.J., *See* Connell, P.S., 14:37196
Wunderlich, R.K., *See* Garrett, W.R., 14:37465
Wyman, K., *See* Berner, T., 14:37253

X

Xie, J., *See* Northby, J.A., 14:37697
Xu, X.W., *See* Lee, A.S., 14:35638
Xunan Zhou, *See* Yigui Li, 14:36860

Y

Yaglov, V.N., *See* Volkov, A.I., 14:36757
Yagow, C.E., *See* Sanford, T.W.L., 14:37092
Yakimova, E.E., Radioisotope determination of carbon impurities in cesium polyiodates, 14:36710 (RA;SU;In Russian)
Yakovlev, V.A., *See* Ershov, E.B., 14:37113
Yakovlev, V.V., Support system for loop device operator. Analysis of technological processes, 14:36097 (R;SU;In Russian)
Yakovleva, N.G., Morphological content of rat peripheral blood in combined effect of radiation factors, 14:37371 (RA;SU;In Russian)
Yakshin, V.V., Size-selective extraction of metal salts: the general principles, 14:36831 (RA;SU)
See Laskorin, B.N., 14:36858
Yakubovskij-Lipskij, Yu., *See* Mokrousova, Eh.V., 14:37656
Yamada, Hirofumi., Charge screening in gauge theories at finite temperature and density, 14:37551 (R;JP)
Yamagishi, Shigeru., *See* Matsuura, Kiyokata, 14:37804
Yamamoto, M., *See* Tatsumi, K., 14:36537
Yamano, N., Aerosol sampling and Transport Efficiency Calculation (ASTEC) and application to surtsey/DCH aerosol sampling system: Code version 1.0: Code description and user's manual, 14:36163 (R;US)
Yamashita, M., *See* Mimaki, T., 14:36536
Yamawaki, Michio, *See* Namba, Takashi, 14:36022
Yan, B., Interdiffusion of Au/Ni/Cr on silicon substrate, 14:36529 (BA;FR)
Yanchar, J., GRI (Gas Research Institute) 1983 baseline projection forecast summary. Final report, 14:36263 (R;US)
GRI (Gas Research Institute) 1983 baseline project forecast methodology and assumptions. Final report, November 1983, 14:36264 (R;US)
GRI (Gas Research Institute) 1984 baseline projection forecast summary. Final report, 14:36266 (R;US)
GRI (Gas Research Institute) 1984 baseline project forecast methodology and assumptions. Final report, July 1985, 14:36267 (R;US)
Yanchar, J.M., DRI (Data Resources Inc.) Energy Model/GRI (Gas Research Institute) Hydrocarbon Model and IFCAM linkage. Final report, September 1983, 14:36265 (R;US)
GRI (Gas Research Institute) baseline projection summary. Final report, 14:36262 (R;US)
Yang Wanjin, *See* Niu Lin, 14:35747
Yang, R.L., *See* Hendriksz, P.J., 14:35998
Yang, X.Q., *See* Samuelson, L., 14:36659
Yang, Y.J., Selection and evaluation of diluents in the modified hot water process, 14:35718 (RA;CA)
Yansons, Ya.L., *See* Valbis, Ya.A., 14:37680
Yarber, J.L., *See* Langley, R.A., 14:37758
Yarbrough, D.W., *See* Cook, J.C. Jr., 14:36375
Yassen, F., *See* Paris, P.J., 14:37763
Yeh, G.T., Numerical modeling and tracer study of groundwater—Yenliao Nuclear Power Plant site, Taipei, Taiwan, June 5–12, 1988: Foreign trip report, 14:35796 (R;US)
Yeh, S.D., *See* Roman, C.P., 14:36040
Yelton, W.G., A method of removing oxides from the surface of Fe-Ni-Co alloy particles by chemical etching, 14:36582 (R;US)
Yen, T.F., *See* Lee, A.S., 14:35638
Yerusalimov, A.P., *See* Arakelian, S.G., 14:37520, 14:37521
Yibirin, J., *See* McGee, J., 14:35615
Yigui Li, Thermodynamics of solvent extraction on $(C_8H_{17})_3N$-$C_6H_5CH_3$-UO_2Cl_2-HCl system, 14:36860 (RA;SU)
See Jiufang Lu, 14:35765
Yildirim, E., The regional upgrader concept for oil sand development. Brief overview, 14:35703 (RA;CA)
Yin Lishang, *See* Zhu Shuxiu, 14:37333
Ying, R., Ionization equilibrium in dense plasmas, 14:37748 (D;US)
Yip, S., *See* Lutsko, J.F., 14:36499
See Nguyen, T., 14:37672
Yokobori, Seiichi, Boiling water reactor, 14:35994 (TG;US)
Yokomura, Takeyoshi., *See* Takeuchi, Kiyoshi, 14:36038
Yonker, C.R., *See* Jones, H.K., 14:36731
Yoon, W.H., *See* Chu Tsonglun, 14:36176
York, B.R., *See* Hoffman, D.M., 14:36696
Yorke-Hart, M.A., *See* du Plessis, H.W., 14:36405
Yoshida, Akihisa, Low-energy ion shower doping and its application for electronic devices, 14:35854 (RA;JP;In Japanese)
Yoshida, Hiroyuki., *See* Kozuka, Toshihiko, 14:36992
Yoshii, Hisahiro., Perturbation of c=1 conformal field theory and quantum sine-Gordon theory, 14:37557 (R;JP)
Yoshimoto, M., *See* Sice, H., 14:35637
Yost, A.B., *See* Wilkins, D.A., 14:35679
Youlal, M., *See* Freeman, R.M., 14:37576
Young, D.E., *See* Palkovic, J.A., 14:37051
Young, E.R., Numerical analysis of designs to reduce the kinetic energy of Davis Gun pusher plates, 14:36889 (R;US)
Young, H.W., *See* Lewis, R.E., 14:35938
Young, J.M., *See* Bradshaw, W.M., 14:36416
Young, L., Development of a polarized deuterium target to measure T_{20} in electron storage rings, 14:37572 (R;US)
Young, R., *See* Comaskey, B., 14:36969
Yu, C., Residual radioactive material guidelines: Methodology and applications, 14:35823 (R;US)
Yu, K.B., *See* Zhou, Z.X., 14:36823
Yu, K.M., *See* Chin, D.K., 14:36899
Yu, P.Y., *See* Li, M.F., 14:36699
Yu, T.U., Secondary atomization of coal-water fuels for gas turbine applications: Final report, 14:35581 (R;US)
Yuan, Y.C., *See* Yu, C., 14:35823
Yuskov, A.M., *See* Simonov, V.D., 14:36009

Z

Zaccardelli, C., *See* Adolphsen, C., 14:37096
Zach, J.J., Expectations for training, 14:36002 (RA;US)
Zachar, Z., *See* Bingham, P.M., 14:37291
Zachos, C.K., New infinite-dimensional algebras, sine brackets, and SU (∞), 14:37545 (R;US)
Zafindratafa, G., Local structure of a 2-codimensional conformally flat submanifold in an Euclidean space R^{n+2}, 14:37699 (R;XA)
Zagar, D.M., *See* Rochau, G.E., 14:37774
Zagurskij, A.B., *See* Efimov, K.M., 14:37076
Zajtsev, S.A., Complexing and catalysis in reactions of chlorine isotopic exchange between aluminium chlorides and alkylchlorides in nonaqueous solvating solvents medium, 14:36817 (RA;SU;In Russian)
Zakatov, L.P., *See* Golovanov, Yu.P., 14:37767
Zakharov, M.A., *See* Kuranov, K.E., 14:36790
Zakharov, N.A., Polymorphic transitions in $LiIO_3$ crystals, 14:36809 (RA;SU;In Russian)
Zakharov, Yu.V., On the properties of new corrosion-resistant high-strength steel 06Kh17G19N3AB and it welded joints, 14:36567 (RA;SU;In Russian)
Zaleski, T.E., *See* Weirich, J.B., 14:35626
Zamfir, N.V., *See* Bucurescu, D., 14:37624
Zamick, L., *See* Benczer-Koller, N., 14:37590
Zanelli, J., *See* Rodrigues, L.M.C.S., 14:37426
Zanotto, E.D., Advanced ceramics in Brazil: actual stage and perspectives, 14:36635 (R;BR;In Portuguese)
Zaritskaya, T.S., Optimization of the spectrum for target irradiation, 14:36127 (RA;SU;In Russian)
Zaritskij, V.N., *See* Drits, M.E., 14:36547
See Potemkin, V.F., 14:36548
Zasadzinski, J.F., *See* Hinks, D.G., 14:36615
Zaworski, J.R., *See* Drost, M.K., 14:36226
Zayhowski, J.D., Single-frequency microchip Nd lasers, 14:36960 (R;US)
Zelle, H.J., *See* Croucher, D.W., 14:36114
Zejnalov, Sh.S., *See* Szaro, S., 14:37115
Zelenetsky, A.V., *See* Bychkov, V.M., 14:37618
Zeller, A.F., Effects of insulation on potted superconducting coils, 14:36917 (J;US)
Zeller, M., *See* Barnes, P.D., 14:37496
Zeller, R.T., *See* Barter, C., 14:37104
See Cutts, D., 14:37103, 14:37105, 14:37106

Zeman, G.H., Intercomparison of neutron-dosimetry techniques at the AFFRI (Armed Forces Radiobiology Research Institute) TRIGA reactor, 14:37098 (R;US)
Zemanian, T., *See* Bandy, R., 14:36592
Zentis, A., *See* Niessen, H.F., 14:36024
Zentler, J.M., Modeling of the proposed ATA fast correction coils, 14:37046 (R;US)
Zertsalov, M.G., *See* Nikolaev, Yu.B., 14:36090
Zettwoog, P., *See* Bernhard, S., 14:35834
See Fourcade, N., 14:35749
See Pourprix, M., 14:35835
Zhang, X.S., *See* Ling, S.C., 14:35577
Zhao Yunlong, Determination of trace gold in rocks and minerals by neutron activation analysis, 14:36705 (R;CN;In Chinese)
Zhao, J., *See* Montano, P.A., 14:37477
Zhavoronkova, K.N., Low-temperature isotopic exchange in molecular hydrogen on films of transition and rare earth metals and their alloys with copper, 14:36813 (RA;SU;In Russian)
Zheltkova, N.N., *See* Savenkova, M.A., 14:36754
Zheng, N.J., *See* Wilson, I.H., 14:36656
Zheng, Y., *See* Baum, H.P., 14:36902
Zherebtsov, V.A., *See* Zvenigorodskij, A.G., 14:37610
Zhesko, T.V., Substantiation of rate setting of surface contamination with amino acids, labelled with tritium, 14:37362 (RA;SU;In Russian)
Zhil'tsov, V.A., Chamber cleaning by glow discharge as a means of the outgassing rate reducing under fast hydrogen atom beam irradiation, 14:37765 (RA;SU;In Russian)
See Golovin, I.N., 14:37769
Zhilkov, S.V., *See* Borovskij, I.V., 14:37061
Zhou Suqing, *See* Zhao Yunlong, 14:36705
Zhou, Z.H., *See* Zhou, Z.X., 14:36823
Zhou, Z.X., Solvent extraction of scandium pigrate by crown ether and crystal structure of complex between picrate and benzo-15-crown-5, 14:36823 (RA;SU)
Zhou, Z.Y., *See* Zhou, Z.X., 14:36823
Zhu Shuxiu, Study on residues and degradation of ^{14}C-phoxim in spring wheat plants and soil, 14:37333 (R;CN;In Chinese)
Zhukovskij, V.G., *See* Aslanov, G.A., 14:37726
Zichy, J.A., Standard-II and extended tests of the Swiss LCT-coil, 14:36915 (J;US)
Ziegler, N.F., [International conference on electrostatic accelerators (ICEA), Strasbourg, France and Heidelberg, Germany, and discussion of electron cyclotron resonance ion sources, Grenoble, France, May 23–29, 1989]: Foreign trip report, 14:37091 (R;US)
Ziehlke, K.T., *See* Henson, H.M., 14:35777
Zielen, A.J., *See* Yu, C., 14:35823
Zilberman, B.Ya., Extraction properties of TBP - uranyl nitrate disolvate, 14:36718 (RA;SU)
Zimin, S.A., Internal shielding of thermonuclear reactors, 14:37766 (RA;SU;In Russian)
Zimina, G.V., *See* Arkhipov, S.M., 14:36806
See Slivko, T.A., 14:36789
Zimmerman, P.W., *See* Jarrell, D.B., 14:36156
Zinkann, G.P., *See* Shepard, K.W., 14:37069
Zinko, H., *See* Brunstroem, C., 14:35935
Zirin, H., Study of weak solar magnetic fields. Final report, 1 December 1987-30 November 1988, 14:37424 (R;US)
Ziritt, J.L., Design and evaluation of pilot tests of steam soak with additives in Venezuela heavy oil reservoirs, 14:35607 (RA;CA)
Znyshev, V.V., Failed element monitor for a NPP, 14:36104 (RA;SU;In Russian)
Structural redundance of NPPs and diagnostics, 14:36101 (RA;SU;In Russian)
Zocco, T.G., Developments in the TEM examination of Pu and Pu alloys, 14:36598 (BA;US)
Zolecki, R., *See* Rosing, M., 14:37070
Zolotarev, S.L., To the study of dynamics of a homogeneous reactor with circulating fuel, 14:36069 (RA;SU;In Russian)
Zolotov, Yu.A., *See* Bagreev, V.V., 14:36716
Zolotova, E.S., *See* Papikyan, S.Kh., 14:36761
Zolotovitskaya, Eh.S., Determination of microimpurities of alkali and alkaline earth elements in lithium and cesium salts of high purity and in monocrystals on their basis, 14:36711 (RA;SU;In Russian)
Zolotukhin, A.V., Impurity ion diffusion in stellaration-type traps, 14:37724 (RA;SU;In Russian)
Zongquan, L., *See* Siegel, R.W., 14:36534
Zorawski, A., *See* Chruscielewski, W., 14:35597
Zou, Z.G., *See* Newberger, B., 14:37049
Zusman, L.L., Vapor pressure over corrosion resistant alkali metal alloys, 14:36552 (RA;SU;In Russian)
See Drits, M.E., 14:36547
See Potemkin, V.F., 14:36548
Zvenigorodskij, A.G., Evaluation of total interaction cross-sections for nuclei with mass number 3, 14:37610 (RA;XA)
Zvyagintsev, A.V., *See* Belikov, V.V., 14:37078

Subject Index

This index is arranged by subject descriptors selected from those assigned to each citation in this publication. Subject descriptors are selected from a controlled thesaurus of terms, *EDB Subject Thesaurus* (DOE/OSTI-7000). In order to enhance indexing, subject descriptor entries generally consist of a pair of descriptors: a main term and a qualifier term. Each entry includes the full title (which may be followed by supplementary descriptive information in parentheses) and the citation number. Additional information given in parentheses indicates the document type (an abbreviation such as B for book), the country of publication (such as DE for Federal Republic of Germany), and the language if non-English.

See references guide users from synonymous terms to the descriptors selected for the concept. *See also* references indicate subject concepts that are more specific than a particular descriptor. To gain complete subject coverage, all such terms should be reviewed.

A

A 285 STEEL
See STEEL-ASTM-A285

A CODES
Aerosol sampling and Transport Efficiency Calculation (ASTEC) and application to surtsey/DCH aerosol sampling system: Code version 1.0: Code description and user's manual, 14:36163 (R;US)

A RESONANCES
See MESONS

A2H-1320 RESONANCES
See MESONS

A2L-1280 RESONANCES
See MESONS

ABNORMALITIES (CHROMOSOMAL)
See CHROMOSOMAL ABERRATIONS

ABSORBED DOSES
See RADIATION DOSES

ACCELERATOR FACILITIES
See also STANFORD LINEAR COLLIDER
Novel methods of acceleration. Final report, 30 September 1983-29 September 1988, 14:37067 (R;US)
Report of the kaon subcommittee of nuclear science advisory committee: Final report, 14:37496 (R;US)

ACCELERATORS
See also COLLECTIVE ACCELERATORS
ELECTROSTATIC ACCELERATORS
LINEAR ACCELERATORS
PARTICLE BEAM FUSION ACCELERATOR
RAILGUN ACCELERATORS
A technique for efficiently cleaning and conditioning low- and medium-energy accelerators, 14:37045 (R;US)
Application of novel material in crystal accelerator concepts, 14:37049 (R;US)
High-energy physics. Panorama of programs. Description of the problem situation, 14:37518 (R;SU;In Russian)
Normal state resistance and low temperature magnetoresistance of superconducting cables for accelerator magnets, 14:36946 (J;US)
Offline computing farms, 14:37028 (R;US)
Physics of particle accelerators: Volume 1, 14:37026 (B;US)
Physics of particle accelerators: Volume 2, 14:37027 (B;US)
Training in test samples of superconducting cables for accelerator magnets, 14:36933 (J;US)

ACCESS DENIAL SYSTEMS
See ENTRY CONTROL SYSTEMS

ACCIDENTAL IRRADIATION
See RADIATION ACCIDENTS

ACES
See QUARKS

ACETALDEHYDE
Studies as to the measurement and the chemistry of formaldehyde and acetaldehyde in the lower troposphere, 14:37171 (R;DE;In German)

ACETATES
Identification and characterization of reaction steps and enzyme catalysts involved in the conversion of acetate and methyl groups to methane. Final report, October 1984-October 1987, 14:35860 (R;US)

ACETIC ALDEHYDE
See ACETALDEHYDE

ACETONE
Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, January 15, 1989–April 15, 1989, 14:35553 (R;US)

ACETYLACETONE
Complex formation of lanthanide(111) with acetylacetone studied by the akufve-lison technique, 14:36827 (RA;SU)
Hydration and solvation energies and thermodynamic distribution coefficient of some extraction systems (Extraction systems: TBP-UO_2Cl_2($ThCl_4$)-HCL; AA-$InCl_3$-HCl, where AA-acetylacetone.), 14:36825 (RA;SU)
Role of the liquid-liquid partition coefficient of the extractable chelate in the extraction efficiency of metals with β-diketones (Metals: rare earths, scandium, yttrium.), 14:36819 (RA;SU)

ACID ELECTROLYTE FUEL CELLS
Improved acid electrolytes for fuel cells. Final report, July 1985-January 1989, 14:36364 (R;US)
Improved acid electrolytes: synthesis and structure of fluorine-containing sulfonic acids for fuel cells. Final report, July 1987-August 1988, 14:36363 (R;US)

ACID RAIN
Acid rain and agricultural production in Ontario, 14:37218 (RA;CA)
Airborne contaminants and aquatic systems. An assessment of research needs, 14:37395 (R;CA)
Characterization of painted surfaces in the United States from the perspective of potential damage from acidic deposition, 14:37163 (R;US)
Effects of ozone and simulated acid rain on mycorrhizal infection in two families of Pinus taeda L, 14:37336 (J;US)
Evaluation of the impact of acid deposition on Eastern Canada's sport fishery, 14:37390 (RA;CA)
Fiscal year 1987 program report (Massachusetts Water Resources Research Center). Annual report, 14:37280 (R;US)
National Performance Audit Program; ambient air audits of analytical proficiency, 1987, 14:37189 (R;US)
Observations of lake trout (Salvelinus namaycush) spawning behaviour in low pH lakes near Sudbury, Ontario, 14:37391 (R;CA)
Preliminary assessment of the current impact and potential risk of acidic deposition on walleye populations in Ontario, 14:37392 (R;CA)
[Fifth international congress of plant pathology, Kyoto, Japan, August 23–27, 1988]: Foreign trip report, 14:37175 (R;US)

ACIDIFICATION
Acidity of surface water in Norway, 14:37242 (RA;NO)
Conceptual model for analysing soil and groundwater acidification on regional scale. International symposium on acidification and water pathways, 14:37239 (RA;NO)

Effects of air pollutants on groundwater quality in the Federal Republic of Germany, 14:37241 (RA;NO)
Mathematical model for podzolic soil profiles exposed to acid deposition, 14:37272 (RA;NO)
Modelling long term stream acidification trends in upland Wales, 14:37271 (RA;NO)
Prediction models for acidification, 14:37270 (RA;NO)
Quality of surface water evolution during snowmelt. International symposium on acidification and water pathways, 14:37238 (RA;NO)

ACIDITY
See PH VALUE

ACIDS (ORGANIC)
See ORGANIC ACIDS

ACRYLIC POLYMERS
See POLYACRYLATES

ACTINIDE COMPLEXES
See also NEPTUNIUM COMPLEXES
PLUTONIUM COMPLEXES
THORIUM COMPLEXES
URANIUM COMPLEXES
Application of eda interactions for explaining and forecasting the extractive ability of elementoorganic reagents, 14:36858 (RA;SU)
Multifunctional organophosphorus extractants: a status report on development and applications, 14:35764 (RA;SU)
Petroleum sulfides, sulfoxides, and sulfones used as extragents (Solvent extraction of actinies, rare earths, transition metals.), 14:36839 (RA;SU)
Prediction and control of extraction ability and some physicochemical properties of extractants (Solvent extraction of actinides and rare earths.), 14:36859 (RA;SU)
Size-selective extraction of metal salts: the general principles (Metals: alkali, alkaline earth, rare earth, transition elements, actinides.), 14:36831 (RA;SU)
Some new developments in actinide solvent extraction systems, 14:36865 (RA;SU)

ACTINIDES
See also AMERICIUM
NEPTUNIUM
PLUTONIUM
URANIUM
Technique for fission measurements of highly active and weak cross-section actinides, 14:37605 (R;US)

ACTIVATED SLUDGE PROCESS
Microbiological investigations on nitrification in waste water treatment plants with fixed sludge beds. Pt. 2. Pilot scale test. Final report, 14:35903 (R;DE;In German)

ACTIVATION ANALYSIS
Activation analysis of air particulate matter, 14:36720 (R;DE)
Neutron activation of large samples using a one milligram Californium 252 source, 14:35852 (RA;ZA)

ADENOCARCINOMAS
See CARCINOMAS

ADGEZATOR
See ELECTRON-RING ACCELERATORS

ADHESION
Understanding oxide-metal interfaces, 14:36620 (BA;FR)

ADHESIVES
In situ high-temperature cross-sectional TEM specimen preparation, 14:36651 (BA;US)

ADVANCED TEST IDAHO REACTOR
See ATR REACTOR

AEROSOL MONITORING
Aerosol sampling and Transport Efficiency Calculation (ASTEC) and application to surtsey/DCH aerosol sampling system: Code version 1.0: Code description and user's manual, 14:36163 (R;US)

AEROSOLS
See also RADIOACTIVE AEROSOLS
SMOKES
A sensitivity of aerosol agglomeration and deposition using the MAEROS model, 14:36188 (BA;US)
Activation analysis of air particulate matter, 14:36720 (R;DE)
Effects on consequences of the high steam content in LWR accident releases, 14:36195 (BA;US)
Health-hazard evaluation determination report No. 73-185-256, Electromotive-Division, GMC (Plant 2), Chicago, Illinois, 14:37186 (R;US)
Health-hazard evaluation determination report No. 75-109, 110, 112, 114-274, Fairbanks Weighing Division, Colt Industries, St. Johnsbury, Vermont, 14:37182 (R;US)
Health-hazard evaluation determination report No. 75-178-295, New York Telephone and Telegraph Company, 770 Broadway, New York, New York, 14:37183 (R;US)
LWR aerosol containment experiments (LACE) program and initial test results, 14:36187 (BA;US)
[European aerosol conference and workshop on aerosol deposition to natural surfaces, Lund, Goteborg, and Stockholm, Sweden, and Oslo, Norway, August 29–September 17, 1988]: Foreign trip report, 14:37176 (R;US)

AFFRI REACTOR
See AFRRI REACTOR

AFRICA
See also MADAGASCAR
SOUTH AFRICA
Energy in West and Central Africa: issues, problems, and donor activities. Final report, 14:36261 (R;US)

AFRRI REACTOR
Intercomparison of neutron-dosimetry techniques at the AFFRI (Armed Forces Radiobiology Research Institute) TRIGA reactor, 14:37098 (R;US)

AGE ESTIMATION
Thirteenth radioactive conference, radiocarbon measurements and applications, Dubrovnik, Yugoslavia, June 20–25, 1988: Foreign trip report, 14:37406 (R;US)

AIR
Automatic programmable air sampling stations. Instruction manual, 14:37118 (R;AT;In German)

AIR CLEANING SYSTEMS
Submerged gravel scrubber demonstration as a passive air cleaner for containment venting and purging with sodium aerosols—CSTF tests AC7–AC10, 14:36028 (R;US)

AIR CONDITIONING
Comparison of conventional mixing and displacement air conditioning and ventilating systems in US commercial buildings, 14:36386 (R;US)

AIR POLLUTION
Atmospheric modeling of air pollution. September 1984-March 1988 (Citations from the NTIS data base). Report for September 1984-March 1988, 14:37194 (R;US)
Characterization of painted surfaces in the United States from the perspective of potential damage from acidic deposition, 14:37163 (R;US)
Effect of acidification on structures in soil and water, 14:37268 (RA;NO)
Effects of air pollutants on groundwater quality in the Federal Republic of Germany, 14:37241 (RA;NO)
Field studies for determining the characteristics and dynamics of local circulations, 14:37164 (R;US)
HEGADAS: heavy gas dispersion program. User's guide, 14:37178 (R;GB)
Southern California Air Quality Study: fall study. Final report, 14:37188 (R;US)
User's guide to SDM- a Shoreline Dispersion Model, 14:37177 (R;US)
[European aerosol conference and workshop on aerosol deposition to natural surfaces, Lund, Goteborg, and Stockholm, Sweden, and Oslo, Norway, August 29–September 17, 1988]: Foreign trip report, 14:37176 (R;US)

AIR POLLUTION CONTROL
Guidance for the preparation of quality-assurance plans for O_3/CO SIP (State Implementation Plan) emission inventories. Final report, 14:37205 (R;US)

AIR POLLUTION MONITORING
See also AEROSOL MONITORING
National Air Audit System FY 1986-1987 national report. Final report, 14:37192 (R;US)

National Performance Audit Program; ambient air audits of analytical proficiency, 1987, 14:37189 (R;US)

AIR POLLUTION MONITORS
Performance of sulfation and nitration plates used to monitor atmospheric pollutant deposition in a real environment, 14:37172 (R;CA)
Review of environmental monitoring equipment for air water and soil systems. Vol. 2-Environmental monitoring equipment database, 14:35966 (R;CA)
Review of environmental monitoring equipment for air, water and soil systems. Vol. 1 - Instrument review, 14:35967 (R;CA)
Review of environmental monitoring equipment for air, water and soil systems. Vol. 2(iii)-Equipment data sheets. Record #529-586, user and utility information records, 14:35964 (R;CA)
Review of environmental monitoring equipment for air, water and soil systems. Vol 2(ii)-Equipment data sheets. Record #247-528, 14:35965 (R;CA)

AIR QUALITY
Proceedings of the 20th DOE/NRC nuclear air cleaning conference: An index to the 1st–20th AEC/ERDA/DOE and DOE/NRC nuclear air cleaning conferences, 14:37202 (R;US)
Proceedings of the 20th DOE/NRC nuclear air cleaning conference: Sessions 6–15, 14:37201 (R;US)

AIRBORNE PARTICLES
See PARTICULATES

AIRBORNE PARTICULATES
See PARTICULATES

AIRPORTS
Eligibility of noise-abatement proposals for grants-in-aid under the airport improvement program, 14:37398 (R;US)

ALARM SYSTEMS
See also INTRUSION DETECTION SYSTEMS
MOTION DETECTION SYSTEMS
Method for calculating optimal rules of making the decisions about accidents in commercial equipment, 14:36107 (RA;SU;In Russian)
Modular economical PC-based alarm display system, 14:35845 (R;US)

ALASKA
Characterization and utilization of natural gas in Alaska: Final report, 14:35670 (R;US)

ALBERTA
Alberta's energy and mineral resources, 14:36234 (R;CA)
Alberta/Canada Energy Resources Research Fund annual review, 1987-1988, 14:36238 (R;CA;In English and French)
Applications by Phillips Petroleum Resources, Ltd. for permits to construct pipelines to transport sour gas and fuel gas in the salter field, 14:35683 (R;CA)
Environmental mediation in major oil sands developments. An alternative model to resolution of native, corporate and government interests in resource development approval processes, 14:35741 (RA;CA)
Legal framework for operation of government research and development agencies, 14:35690 (RA;CA)
New oil sands conservation regulations for Alberta, 14:35744 (RA;CA)
Oil sands project application. Review process-mediation, not confrontation, 14:35743 (RA;CA)

ALCOHOL DEHYDROGENASE
Effect of temperature on Ty transposition, 14:37295 (RA;US)

ALCOHOLS
See also BUTANOLS
ETHANOL
METHANOL
PROPANOLS
Fundamental research on surface science of coal in support of physical beneficiation of coal: Quarterly technical progress report, January 1–March 31, 1989, 14:35551 (R;US)
Separation of low molecular weight alcohols from dilute aqueous solutions by reversible chemical complexation, 14:36725 (R;US)

ALDEHYDO ACIDS
See CARBOXYLIC ACIDS

ALGAE
Fuels from microalgae, 14:35910 (R;US)
Microbial colonization on natural and artificial macrophytes in a phosphorus-limited, hardwater lake, 14:37252 (J;US)
Photoadaptation and the package effect in Dunaliella tertiolecta (Chlorophyceae), 14:37253 (J;US)

ALGORITHMS
Randomized parallel branch-and-bound algorithm, 14:37794 (R;US)
The Outsider interruption algorithm, 14:35849 (R;US)

ALKALI METAL COMPLEXES
See also CESIUM COMPLEXES
POTASSIUM COMPLEXES
Ionizable polyethers as specific metal ion carriers in liquid-liquid extraction and liquid membrane separations (Metals: Li-Cs, Ca, Sr, Ba.), 14:36834 (RA;SU)
Micelle formation during extraction of alkali elements from strongly alkaline mediums (Alkali elements: Cs, Rb, K.), 14:36822 (RA;SU)
Size-selective extraction of metal salts: the general principles (Metals: alkali, alkaline earth, rare earth, transition elements, actinides.), 14:36831 (RA;SU)

ALKALI METAL COMPOUNDS
See also CESIUM COMPOUNDS
LITHIUM COMPOUNDS
POTASSIUM COMPOUNDS

Absorption Spectroscopy
Extraction separation of matrix during flame-photometric and atomic-absorption determination of Li, Rb, Cs in alkaline earth element salts, 14:36714 (RA;SU;In Russian)

Chemical Preparation
Formation conditions and some properties of double nitrates of rare alkali metals and rare earths, 14:36781 (RA;SU;In Russian)
Study of physicochemical properties of alkali metal salts of 12-tungstogallic acid, 14:36768 (RA;SU;In Russian)
Sulfates of rare alkali metals, 14:36799 (RA;SU;In Russian)
Synthesis and structure of mixed by cation ternary vanadates $Me_2MeLn(VO_4)_2$, 14:36745 (RA;SU;In Russian)

Chemical Reactions
Physicochemical study of the systems BiI_3-M^1I (M^1-Li, Na, K, Rb, Cs) and properties of forming compounds, 14:36796 (RA;SU;In Russian)
Study of interaction in ternary bromide systems of lithium, sodium, rubidium, cesium, cadmium, barium, calcium, and lead, 14:36791 (RA;SU;In Russian)
Systems MVO_3-$Zn(VO_3)_2$ and MVO_3-$Mn(VO_3)_2$, where M=Li, Rb, Cs, 14:36770 (RA;SU;In Russian)

Crystal Structure
Regularities of structure and properties of mixed oxides of the composition $ABTeO_6$ (A-K, Rb, Cs, Tl; B-Nb, Ta, Sb), 14:36795 (RA;SU;In Russian)
Synthesis and structure of mixed by cation ternary vanadates $Me_2MeLn(VO_4)_2$, 14:36745 (RA;SU;In Russian)

Crystallization
Condensed phosphates of rare earth and rare alkali elements, 14:36751 (RA;SU;In Russian)
Synthesis and physicochemical study of double chlorides, nitrates, sulfates of rubidium and cesium with calcium, lanthanum, neodymium, ytterbium, 14:36782 (RA;SU;In Russian)

Electric Conductivity
Electric conductivity of ternary phosphates and vanadates of alkali and rare earth metals (Alkali metals: K, Rb, Cs; rare earths: Pr, Ho, Gd.), 14:36746 (RA;SU;In Russian)

Formation Free Enthalpy
Thermodynamic properties of alkali metal chalcogenates, chromates, molybdates, and tungstates, 14:36764 (RA;SU;In Russian)

Formation Heat
Thermodynamic properties of alkali metal chalcogenates, chromates, molybdates, and tungstates, 14:36764 (RA;SU;In Russian)

Fusion Heat
Enthalpies of melting and polymorphic transformations of alkali metal molybdates, tungstates, and chromates, 14:36761 (RA;SU;In Russian)
Glass
Condensed phosphates of rare earth and rare alkali elements, 14:36751 (RA;SU;In Russian)
Infrared Spectra
Connection between structure of alkali metal molybdates and tungstates and their spectral and energetic characteristics, 14:36763 (RA;SU;In Russian)
Ion Exchange
Regularities of structure and properties of mixed oxides of the composition $ABTeO_6$ (A-K, Rb, Cs, Tl; B-Nb, Ta, Sb), 14:36795 (RA;SU;In Russian)
Melting Points
Low-melting alloys of halide and nitrate systems of alkali and alkaline earth metals and their practical use, 14:36785 (RA;SU;In Russian)
Molecular Structure
Connection between structure of alkali metal molybdates and tungstates and their spectral and energetic characteristics, 14:36763 (RA;SU;In Russian)
Permittivity
Electric conductivity of ternary phosphates and vanadates of alkali and rare earth metals (Alkali metals: K, Rb, Cs; rare earths: Pr, Ho, Gd.), 14:36746 (RA;SU;In Russian)
Phase Diagrams
Formation conditions and some properties of double nitrates of rare alkali metals and rare earths, 14:36781 (RA;SU;In Russian)
Low-melting alloys of halide and nitrate systems of alkali and alkaline earth metals and their practical use, 14:36785 (RA;SU;In Russian)
Physicochemical study of the systems BiI_3-M^1I (M^1-Li, Na, K, Rb, Cs) and properties of forming compounds, 14:36796 (RA;SU;In Russian)
Solubility of sulfates and oxalates of alkaline earth metals in aqueous solutions of alkali metal salts (Alkali metals: Li-Cs.), 14:36800 (RA;SU;In Russian)
Study of interaction in ternary bromide systems of lithium, sodium, rubidium, cesium, cadmium, barium, calcium, and lead, 14:36791 (RA;SU;In Russian)
Sulfates of rare alkali metals, 14:36799 (RA;SU;In Russian)
Synthesis and physicochemical study of double chlorides, nitrates, sulfates of rubidium and cesium with calcium, lanthanum, neodymium, ytterbium, 14:36782 (RA;SU;In Russian)
Systems MVO_3-$Zn(VO_3)_2$ and MVO_3-$Mn(VO_3)_2$, where M=Li, Rb, Cs, 14:36770 (RA;SU;In Russian)
Pyrolysis
Study of physicochemical properties of alkali metal salts of 12-tungstogallic acid, 14:36768 (RA;SU;In Russian)
Quantitative Chemical Analysis
Determination of microimpurities of alkali and alkaline earth elements in lithium and cesium salts of high purity and in monocrystals on their basis, 14:36711 (RA;SU;In Russian)
Extraction separation of matrix during flame-photometric and atomic-absorption determination of Li, Rb, Cs in alkaline earth element salts, 14:36714 (RA;SU;In Russian)
Transition Heat
Enthalpies of melting and polymorphic transformations of alkali metal molybdates, tungstates, and chromates, 14:36761 (RA;SU;In Russian)

ALKALI METALS
See also CESIUM
LITHIUM
RUBIDIUM
Saturation behavior of parametric four-wave mixing due to two-photon interference effect, 14:37465 (R;US)
Surface tension of alkali metals and alloys, 14:36555 (RA;SU;In Russian)

ALKALINE EARTH METAL COMPLEXES
See also BERYLLIUM COMPLEXES
STRONTIUM COMPLEXES
Extraction separation of matrix during flame-photometric and atomic-absorption determination of Li, Rb, Cs in alkaline earth element salts, 14:36714 (RA;SU;In Russian)
Ionizable polyethers as specific metal ion carriers in liquid-liquid extraction and liquid membrane separations (Metals: Li-Cs, Ca, Sr, Ba.), 14:36834 (RA;SU)
Size-selective extraction of metal salts: the general principles (Metals: alkali, alkaline earth, rare earth, transition elements, actinides.), 14:36831 (RA;SU)

ALKALINE EARTH METAL COMPOUNDS
See also BARIUM COMPOUNDS
CALCIUM COMPOUNDS
STRONTIUM COMPOUNDS
Determination of microimpurities of alkali and alkaline earth elements in lithium and cesium salts of high purity and in monocrystals on their basis, 14:36711 (RA;SU;In Russian)
Extraction separation of matrix during flame-photometric and atomic-absorption determination of Li, Rb, Cs in alkaline earth element salts, 14:36714 (RA;SU;In Russian)
Low-melting alloys of halide and nitrate systems of alkali and alkaline earth metals and their practical use, 14:36785 (RA;SU;In Russian)
Metastable ordered compounds formed during epitaxial growth, 14:36539 (BA;FR)
Solubility of sulfates and oxalates of alkaline earth metals in aqueous solutions of alkali metal salts (Alkali metals: Li-Cs.), 14:36800 (RA;SU;In Russian)
Study of interaction in ternary bromide systems of lithium, sodium, rubidium, cesium, cadmium, barium, calcium, and lead, 14:36791 (RA;SU;In Russian)

ALKANOIC ACIDS
See CARBOXYLIC ACIDS

ALKENOIC ACIDS
See CARBOXYLIC ACIDS

ALKYLATES
See ALCOHOLS

ALLOY 800
See INCOLOY 800

ALLOY 800H
See INCOLOY 800H

ALLOY SU31
See NIOBIUM BASE ALLOYS

ALLOY-1915
See ALUMINIUM BASE ALLOYS

ALLOY-214X
See ALUMINIUM BASE ALLOYS

ALLOY-50KH4N6G12F2V
See CHROMIUM ALLOYS

ALLOY-60T
See TITANIUM BASE ALLOYS

ALLOY-79NM
See NICKEL BASE ALLOYS

ALLOY-A-286
Microstructure and stress corrosion resistance of alloys X-750, 718, and A-286 in LWR environments: Final report, 14:36544 (R;US)

ALLOY-B-66
See NIOBIUM BASE ALLOYS

ALLOY-B-88
See NIOBIUM BASE ALLOYS

ALLOY-C-129Y
See NIOBIUM BASE ALLOYS

ALLOY-CB-1
See NIOBIUM BASE ALLOYS

ALLOY-CB-752
See NIOBIUM BASE ALLOYS

ALLOY-D-43
See NIOBIUM BASE ALLOYS

ALLOY-DH-245
See NIOBIUM BASE ALLOYS

ALLOY-FS-85
See NIOBIUM BASE ALLOYS

ALLOY-GE
See COPPER ALLOYS
SILVER ALLOYS

ALLOY-GMR-235
See NICKEL BASE ALLOYS

ALLOY-HD-8077
See NICKEL BASE ALLOYS

ALLOY-KH20N80T
See NICKEL BASE ALLOYS

ALLOY-KHN77TYU
See NICKEL BASE ALLOYS

ALLOY-L-605
See COBALT BASE ALLOYS

ALLOY-M-252
See NICKEL BASE ALLOYS

ALLOY-MA-754
See NICKEL BASE ALLOYS

ALLOY-MA-956
See IRON BASE ALLOYS

ALLOY-MM-0011
See NICKEL BASE ALLOYS

ALLOY-VTZ-1
See TITANIUM BASE ALLOYS

ALLOY-VUS-6
See NIOBIUM BASE ALLOYS

ALLOY-WAZ-16
See NICKEL BASE ALLOYS

ALLOYS
See also ALUMINIUM ALLOYS
BORON ALLOYS
CADMIUM ALLOYS
CESIUM ALLOYS
CHROMIUM ALLOYS
COBALT ALLOYS
COPPER ALLOYS
CORROSION RESISTANT ALLOYS
GERMANIUM ALLOYS
GOLD ALLOYS
HAFNIUM ALLOYS
HEAT RESISTING ALLOYS
INTERMETALLIC COMPOUNDS
IRON ALLOYS
LEAD ALLOYS
LITHIUM ALLOYS
MAGNESIUM ALLOYS
MANGANESE ALLOYS
NICKEL ALLOYS
NIOBIUM ALLOYS
POTASSIUM ALLOYS
RARE EARTH ALLOYS
RUBIDIUM ALLOYS
SCANDIUM ALLOYS
SILVER ALLOYS
SODIUM ALLOYS
SULFUR ADDITIONS
TANTALUM ALLOYS
TIN ALLOYS
TITANIUM ALLOYS
TUNGSTEN ALLOYS
VANADIUM ALLOYS
YTTRIUM ALLOYS
ZINC ALLOYS
ZIRCONIUM ALLOYS
Transport in metal alloys and resistivity saturation, 14:37695 (BA;US)

ALPHA BEAMS
Selective population of the highest spin n-p states in heavy nuclei via the (α, d) reaction at 218 MeV, 14:37588 (R;FR)

ALPHA SPECTRA
Program listings for GRPANL: A suite of computer programs for analyzing complex Ge and alpha-particle detector spectra: Volume 3, 14:37120 (R;US)

ALPHA-BEARING WASTES
1988 DOE model conference proceedings: Volume 1, 14:35771 (R;US)
TRUEX process laboratory studies with Hanford complexant concentrate waste: Part 2, Test for solvent poisoning, 14:35806 (R;US)
Treatment needs for Greater-Than-Class C low-level waste, 14:35804 (R;US)

ALUMINIA
See ALUMINIUM OXIDES

ALUMINIUM
Aluminium dynamics in response to experimental additions of acid to a small Norwegian stream, 14:37266 (RA;NO)
Effect of high pressures on the mobility of atoms in grain boundaries, 14:36516 (BA;FR)
Effect of the triple junction on grain-boundary sliding in aluminum tricrystals, 14:36524 (BA;FR)
Energy and structure of [100] aluminum grain boundary, 14:36519 (BA;FR)
Evolution of the chemistry of passive films of sputter-deposited, supersaturated Al alloys. Annual report, 1 July 1987-30 November 1988, 14:36461 (R;US)
Increased acidity and aluminium concentration in streams following afforestation: Causative mechanisms and processes, 14:37243 (RA;NO)
Introduction of experience of television information-control systems in welding, 14:36569 (RA;SU;In Russian)
Mechanical behaviors of SiC whisker reinforced Al composites by powder metallurgical process, 14:36528 (BA;FR)
Novel approaches to ionic chromatography: Progress report, December 1, 1987–June 30, 1989, 14:36707 (R;US)
Phase equilibria and interfacial phenomena in the Mg-Al-O system at 800°C, 14:36500 (BA;FR)
Reaction kinetics of phase formation in Nb-Al powder metallurgy processed wire, 14:36944 (J;US)
Search for experimentally observed grain boundary phase transitions, 14:36498 (BA;FR)
Simulation study of interfaces in Ni, Al and Ni_3Al with and without boron, 14:36488 (BA;FR)
Strain-induced boundary migration (SIBM) in aluminum bicrystals each with a (211) tilt boundary, 14:36525 (BA;FR)
Structure of asymmetrical tilt boundaries formed during creep of (112) oriented aluminum single crystals, 14:36493 (BA;FR)
TEM study of ZrO_2/Al interface, 14:36629 (BA;FR)
The preparation of mechanically alloyed powders for TEM examination, 14:36596 (BA;US)

ALUMINIUM 27 TARGET
Fast-fission component with small mass drift in the reaction $^{84}Kr + {}^{27}Al$ at E_{Lab} = 5.9 MeV/u, 14:37587 (R;FR)
Survey of results from Brookhaven Experiment 802 at the AGS, 14:37596 (R;US)

ALUMINIUM ALLOYS
See also ALUMINIUM BASE ALLOYS
An Auger sputter profiling study of nitrogen and oxygen ion implantation in two titanium alloys, 14:37688 (R;US)
Application of the embedded atom method to the fracture of interfaces, 14:36514 (BA;FR)
Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1, 14:35538 (R;US)
Cyclic migration and fracture in solid solution alloys, 14:36988 (BA;FR)
Dynamic studies of deformation and fracture at grain boundaries, 14:36533 (BA;FR)
Effect of chromium on early stages of oxidation of Ni_3Al alloys at 600°C, 14:36608 (J;US)
Effect of grain-boundary structure on stress corrosion cracking in αCu-Al alloy bicrystals, 14:36536 (BA;FR)
Electronic theory for grain boundary segregation and embrittlement of intermetallic compound Ni_3Al, 14:36518 (BA;FR)
Evolution of the chemistry of passive films of sputter-deposited, supersaturated Al alloys. Annual report, 1 July 1987-30 November 1988, 14:36461 (R;US)
Grain boundary structure in Ni_3Al, 14:36492 (BA;FR)

Hydrogen embrittlement in grain boundaries studied by fatigue crack propagation in Al-Zn-Mg bicrystals, 14:36987 (BA;FR)
Optical properties of metals and alloys: Au, Ag, FeRh, $AuAl_2$, and $PtAl_2$, 14:36604 (D;US)
Reaction kinetics of phase formation in Nb-Al powder metallurgy processed wire, 14:36944 (J;US)
Sulfidation/oxidation properties of iron-based alloys containing niobium and aluminum, 14:35539 (R;US)
The failure of aluminum compact shear specimens under mixed-mode loading, 14:36597 (BA;US)
[2nd international symposium on high-temperature corrosion of advanced materials and coatings, Les Embiez, France, and visit to Manchester, England, May 19–27, 1989]: Foreign trip report, 14:35536 (R;US)

ALUMINIUM ARSENIDES
Lattice relaxation of the DX centers in $Ga_{1-x}Al_xAs$ and of the pressure-induced deep donors in GaAs, 14:36699 (BA;US)
Pressure-dependent DLTS experiments on Si-doped AlGaAs, 14:36700 (BA;US)

ALUMINIUM BASE ALLOYS
New generation of welded semiautomatic for production of structures out of steels and aluminium alloys, 14:36566 (RA;SU;In Russian)
Optimization of technological parameters of welding process by stabilized arc of reverse polarity, 14:36562 (RA;SU;In Russian)

ALUMINIUM CARBIDES
High resolution electron microscopy of interfaces in functional materials, 14:36623 (BA;FR)

ALUMINIUM NITRIDES
Atomic structure of vitreous interfacial films in sialon, 14:36671 (BA;FR)
Cu-AlN interface: electronic structure and adhesion, 14:36542 (BA;FR)
HVEM and HREM of interfaces in aluminum nitride ceramics, 14:36624 (BA;FR)

ALUMINIUM OXIDES
Atomic structure of vitreous interfacial films in sialon, 14:36671 (BA;FR)
Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1, 14:35538 (R;US)
Contribution of lattice matching to the interfacial energy between dissimilar materials, 14:36622 (BA;FR)
Hetero- and homo-phase boundaries in ceramic oxides, 14:36626 (BA;FR)
Influence of doping elements on the grain boundary characteristics in alumina, 14:36632 (BA;FR)
Phase equilibria and interfacial phenomena in the Mg-Al-O system at 800°C, 14:36500 (BA;FR)
Subcritical crack growth in metal-ceramic-interfaces, 14:36986 (BA;FR)
The amorphous to gamma transformation in ion implanted Al_2O_3, 14:36618 (R;US)
The role of acid-base site in the preparation of $A1_20_3$-supported platinum catalysts, 14:36734 (RA;CA)

ALUMINIUM SILICATES
Interfacial characteristics of glass-ceramic matrix/SiC fiber composites, 14:36634 (BA;FR)

ALUMINUM
See ALUMINIUM

AMERICIUM
Sorption of radionuclides on London clay, 14:37224 (R;GB)

AMIDES
See also UREA
Metal extraction by amides of carboxylic acids, 14:36719 (RA;SU)

AMINES
See also QUATERNARY COMPOUNDS
TOA
Determination of thermodynamic characteristics of extraction equilibria in the systems containing ammonium salts and organic phosphorus compounds (Solvent extraction of nitrates of Ce, Pr, Eu, UO_2^{2+}, Th.), 14:36717 (RA;SU)
Equilibrium on metal extraction with substituted ammonium salts effect of non-ideality of the organic phase, 14:36861 (RA;SU)
Extractants for boron, 14:36836 (RA;SU)
Prediction and control of extraction ability and some physicochemical properties of extractants (Solvent extraction of actinides and rare earths.), 14:36859 (RA;SU)
Some possibilities for improvement of the extraction properties in mixed extraction systems, 14:36838 (RA;SU)
State of water in extracts and its interaction with microwave field, 14:36824 (RA;SU)

AMINO ACIDS
See also THYROXINE
Optimization of separation efficiency in capillary zone electrophoresis, 14:36731 (BA;US)

AMINO ALCOHOLS
See ALCOHOLS
AMINES

AMINO SUGARS
See AMINES

AMINOGLYCIDES
See AMINES

AMMONIA
Novel approaches to ionic chromatography: Progress report, December 1, 1987–June 30, 1989, 14:36707 (R;US)
Structure and reactivity of chemisorbed species and reaction intermediates: Progress report, December 1, 1984–November 30, 1985, 14:36742 (R;US)

AMMUNITION
Corrosion of high-density sintered tungsten alloys. Part 1. Immersion testing, 14:36463 (R;AU)
Corrosion of high-density sintered tungsten alloys. Part 2. Accelerated corrosion testing, 14:36464 (R;AU)

ANADROMOUS FISHES
See also SALMON
Feasibility of implementing the least-cost model, 14:35887 (RA;US)
Identifying the most cost-effective fish mitigation strategy: the least-cost model, 14:35886 (RA;US)
Overview of models, 14:35877 (RA;US)

ANALOG RESONANCES
See RESONANCE

ANALYSIS (ACTIVATION)
See ACTIVATION ANALYSIS

ANALYSIS (THERMAL)
See THERMAL ANALYSIS

ANESTHETICS
Health-hazard evaluation determination report No. 75-151-259, Winchester Hospital, Winchester, Massachusetts, 14:37184 (R;US)

ANGIOGRAPHY
See BIOMEDICAL RADIOGRAPHY

ANGULAR CORRELATION
Implementation of computer programmes for fitting of positron annihilation spectra on "personal computers". Final report for the period 1 May 1986 - 14 June 1988, 14:37468 (R;XA)

ANHYDRIDES
Study of improved methods for predicting chemical equilibria: Composite technical progress report, July 1, 1986–June 30, 1989, 14:36739 (R;US)

ANIMAL CELLS
See also TUMOR CELLS
In vitro radiosensitivity of human malignant melanoma cells to low and high LET radiation, 14:37350 (RA;AU)
Inducible cellular responses to DNA damage, 14:37387 (RA;US)
Radiation sensitivity of human natural killer cells recognising bone marrow targets, 14:37352 (RA;AU)

ANIONS
Windows on the axion, 14:37517 (R;US)

ANISOTROPY
Polycrystal plasticity as applied to the problem of in-plane anisotropy in rolled cubic metals, 14:36572 (R;US)

ANNEALING
Ab-initio calculation of the microscopic properties of a grain boundary in germanium, 14:36487 (BA;FR)

ANNUAL CYCLE ENERGY SYSTEM
An annual storage ice system for summer cooling, 14:36209 (RA;CA;In English and French)
The "Fabrikaglace" process to make and store natural ice, 14:36208 (RA;CA;In English and French)

ANODES
Impedance spectroscopy for the study of anodic copper dissolution in sulfuric acid in presence of benzotriazole, 14:36367 (BA;US)
The nature and composition of the passive film formed on Ni-P-Cr metallic glasses, 14:36366 (BA;US)

ANOXIA
Induction of VL30 element expression as a response to anoxic stress, 14:37388 (RA;US)

ANTHRACENE
Study of improved methods for predicting chemical equilibria: Composite technical progress report, July 1, 1986–June 30, 1989, 14:36739 (R;US)

ANTHRAQUINONES
Supercritical fluid thermodynamics for coal processing: Quarterly progress report, September 15, 1988–December 31, 1988, 14:35529 (R;US)

ANTILAMBDA PARTICLES
Lambda-antilambda decay asymmetries and CP violation, 14:37504 (R;US)

ANTIMONY
Grain boundary electrical activity of n-type germanium, 14:36532 (BA;FR)

ANTINEUTRINO-ELECTRON INTERACTIONS
Elastic scattering of muon-neutrinos and muon-anti-neutrinos by electrons, 14:37499 (R;US)

ANTRIM SHALES
See BLACK SHALES

APPALACHIAN MOUNTAINS
Evaluating spatial patterns of forest productivity in a disturbed, mountainous landscape using LANDSAT data and a GIS, 14:37338 (J;US)

APPLIANCES
See also ELECTRIC APPLIANCES
STOVES
WATER HEATERS
WOOD BURNING APPLIANCES
Bibliography of the DOE building equipment research program, 14:36376 (R;US)

APPROXIMATION (BOHR)
See NILSSON-MOTTELSON MODEL

AQUATIC ECOSYSTEMS
See also WETLANDS
Airborne contaminants and aquatic systems. An assessment of research needs, 14:37395 (R;CA)
Contribution to origin of the reefs in northeastern, 14:37208 (R;BR;In Portuguese)
Ocean waste disposal: outfall sewers. January 1977-April 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-April 1989, 14:36441 (R;US)

AQUATIC ORGANISMS
See also FISHES
MANATEES
PLANKTON
AQUIRE: Aquatic Toxicity Information Retrieval data base. Data file, 14:37275 (R;US)
Effects of structure on scattering from marine organisms, 14:37250 (BA;US)
Immobilization of unicellular marine organisms for optical characterization, 14:37251 (BA;US)

AQUIFERS
Presentation of a software package for automated evaluation of soil heat storage projects, 14:36210 (RA;CA;In French)
The aquifer chill storage project at the University of Alabama, Tuscaloosa: Progress report for 1985 and 1986, 14:36218 (R;US)

ARC WELDING
See also GAS TUNGSTEN-ARC WELDING
Methods of deformation estimation of weldpool surfaces from action of localized pressure under through fusion, 14:36570 (RA;SU;In Russian)
New generation of welded semiautomatic for production of structures out of steels and aluminium alloys, 14:36566 (RA;SU;In Russian)

AREA POLLUTION SOURCES
See POLLUTION SOURCES

ARGENTINA
Geological and geophysical investigations at Sierra del Medio massif - Argentine, 14:37403 (R;AR)

ARGON
Molecular dynamics study of the structure and properties of twist boundaries, 14:36669 (BA;FR)

ARGON 40 REACTIONS
Multiple angular scattering of heavy ions $^{16-17}O$, ^{40}Ar, ^{86}Kr, ^{100}Mo at intermediate energies (20-90 MeV/u), 14:37682 (R;FR)
Multiplicity of neutrons from violent heavy-ion collisions: ^{40}Ar + Th and U from 10 to 77 MeV/u, 14:37603 (R;DE)

ARGON 40 TARGET
Fusion-fission of heavy systems: influence of the entrance channel mass asymmetry, 14:37578 (R;FR)

ARGON IONS
Dynamical aspects of violent collisions in Ar + Ag reactions at E/A = 27 MeV, 14:37472 (R;FR)

ARGONNE SUPERCONDUCTING LINAC
See ATLAS SUPERCONDUCTING LINAC

AROMATIC ACIDS
See CARBOXYLIC ACIDS

AROMATIC COMPOUNDS
See AROMATICS

AROMATICS
See also BENZENE
BIPHENYL
PHENOLS
Tritium labeling by thermally generated tritons, 14:36845 (R;US)

ARRAY PROCESSORS
Developing software to use parallel processing effectively. Final report, June-December 1987, 14:37797 (R;US)
Expert systems on multiprocessor architectures. Phase 1. Final report, March 1985-July 1987, 14:37795 (R;US)

ARSENIC
Critical phenomenon and segregation behavior at interfaces and subgrain boundaries, 14:36540 (BA;FR)
Ion exchange and soil attenuation of Gulf Coast and Great Plains soils: Final report, 14:37217 (R;US)

ARTIFICIAL LIFTS
Cold Lake artificial lift optimization, 14:35630 (RA;CA)

ASBESTOS
Evaluation of asbestos levels in two schools before and after asbestos removal. Final report, 14:37181 (R;US)
Release of dispersed asbestos fibres from soils, 14:37190 (R;GB)
Testing of hair dryers for asbestos emissions, 14:37180 (R;US)

ASH SEPARATORS
See INERTIAL SEPARATORS

ASHES
See also FLY ASH
Coal ash deposition, interaction with metal substrates and deposit build up: Summary report, 26 February 1989–25 May 1989, 14:35586 (R;US)
Coal-test program in a pressurized, fluidized-bed ash-agglomerating process development unit. Volume 2. Data analysis. Final report, November 15, 1984-August 31, 1987, 14:35544 (R;US)
Development of dredged ash disposal area: Johnsonville Fossil Plant: Final environmental assessment, 14:35564 (R;US)
Ion exchange and soil attenuation of Gulf Coast and Great Plains soils: Final report, 14:37217 (R;US)

ASPENS
Proceedings of the workshop on aspen pulp, paper and chemicals, 14:35900 (R;CA)

ASPHALTENES
Coking of oil sand, asphaltenes and residual oils in the LR-process, 14:35705 (RA;CA)
Upgrading of heavy crude at low-temperature and ambient-atmosphere, 14:35638 (RA;CA)

ATF TORSATRON
Panel discussion: Progress and plans for magnetic fusion: Summary of comments on recent progress in fusion research at the Oak Ridge National Laboratory, 14:37716 (R;US)
Recent results on cleaning and conditioning the ATF vacuum system, 14:37758 (R;US)

ATHABASCA DEPOSIT
Athabasca mineable oil sands. The RTR/Gulf extraction process theoretical model of bitumen detachment, 14:35717 (RA;CA)

Exploitation
AOSTRA underground test facility: mining access for research and production, 14:35721 (RA;CA)

Geologic Structures
A quantitative approach to the geological evaluation of the tar sands of south Athabasca, Alberta, 14:35697 (RA;CA)

In-Situ Combustion
A pressure observation well for monitoring and optimizing the pressure-up blowdown combustion process, 14:35711 (RA;CA)
Oil sands formation preheating study, 14:35714 (RA;CA)

Paleontology
The McMurray formation in the Athabasca oil sands area: an ichnological and paleontological perspective, 14:35695 (RA;CA)

Petroleum Geology
Geology and resources of the primrose crude bitumen deposits northeastern Alberta, 14:35696 (RA;CA)
Geology of the AOSTRA underground test facility site, 14:35698 (RA;CA)
Resource characterization of the central region of the lower Cretaceous McMurray/Wabiskaw deposit, Athabasca oil sands area, northeastern Alberta, 14:35699 (RA;CA)

Petroleum Refineries
OSLO project update and upgrader technology selection, 14:35729 (RA;CA)

Sedimentation
Fluvial, estuarine and shallow marine sedimentation in the Lower Cretaceous McMurray Formation and Wabiskaw Member (Clearwater Formation), in the central region, Athabasca oil sands area, northeastern Alberta, 14:35694 (RA;CA)

Steam Injection
Analysis and implementation of the steam assisted gravity drainage process at the AOSTRA UTF, 14:35708 (RA;CA)
Geotechnical instrument tation of the AOSTRA mine-assisted underground steaming trial, 14:35720 (RA;CA)
In situ oil sands temperature logging, 14:35725 (RA;CA)
Oil sands formation preheating study, 14:35714 (RA;CA)
Simulation of HASDrive UTF pilot, 14:35693 (RA;CA)

Stratigraphy
Fluvial, estuarine and shallow marine sedimentation in the Lower Cretaceous McMurray Formation and Wabiskaw Member (Clearwater Formation), in the central region, Athabasca oil sands area, northeastern Alberta, 14:35694 (RA;CA)
Resource characterization of the central region of the lower Cretaceous McMurray/Wabiskaw deposit, Athabasca oil sands area, northeastern Alberta, 14:35699 (RA;CA)
UNITAR/UNDP, 4th international conference on heavy crude and tar sand. Vol. 1, 14:35702 (R;CA)

Test Facilities
Geology of the AOSTRA underground test facility site, 14:35698 (RA;CA)

Underground Facilities
AOSTRA underground test facility: mining access for research and production, 14:35721 (RA;CA)
Geotechnical instrument tation of the AOSTRA mine-assisted underground steaming trial, 14:35720 (RA;CA)

ATLAS SUPERCONDUCTING LINAC
Superconducting low-velocity linac for the Argonne positive-ion injector, 14:37069 (R;US)

ATMOSPHERIC CHEMISTRY
Effects of trace gases on global atmospheric chemical and physical processes, 14:37195 (R;US)

ATMOSPHERIC PRECIPITATIONS
See also RAIN
SNOW
Use of representative field plots for the determination of hydrological flow-paths and associated hydrochemistry in studies of surface water acidification, 14:37261 (RA;NO)

ATMOSPHERIC PRESSURE
Pressure-dependent melting curve of natural carnallite, $KMgCl_3.6H_2O$, in a closed system, where evaporation is prevented, 14:37416 (R;DK)

ATOM COLLISIONS
See also ION-ATOM COLLISIONS
Density dependence of the momentum distribution in normal liquid ^4He, 14:37639 (R;US)

ATOMIC BOMBS
See NUCLEAR WEAPONS

ATOMIC EXPLOSIONS
See NUCLEAR EXPLOSIONS

ATOMIC PHYSICS
Studies of collisional and nonlinear radiative processes for development of coherent uv and xuv sources. Final report, 30 September 1985-29 September 1988, 14:37463 (R;US)

ATOMIC WEAPONS
See NUCLEAR WEAPONS

ATOMS
Physics of spin-polarized atomic vapors. Final report, 1 October 1986-30 April 1988, 14:37461 (R;US)

ATR REACTOR
Developing a performance based retraining program for the advanced test reactor (ATR) reactor operators and supervisors, 14:36113 (RA;US)
Development and implementation of quality based team and diagnostic skills training at the advanced test reactor, 14:36112 (RA;US)
Plant life extension program for the Advanced Test Reactor, 14:36114 (R;US)

AURORAE
See also POLAR-CAP AURORAE
Snapshots of high-latitude electrodynamics using Viking and DMSP f7 observations, 14:37447 (R;US)

AUSTENITIC STEELS
Studies on work-softening processes in the hot forming of austenitic steel, 14:36581 (TJ;US)

AUTOMOBILE EFFICIENCY STANDARDS
See AUTOMOBILES

AUTOMOBILE INDUSTRY
See AUTOMOTIVE INDUSTRY

AUTOMOBILES
Program to assure good in-use vehicle emissions performance in the Federal Republic of Germany through improved compliance with standards. Final report, 14:36449 (R;DE;In German)

AUTOMOTIVE FUELS
Effect of a light-diesel blend formulated by BP on the performance and durability of an ADE 314 diesel engine, 14:36445 (R;ZA)

AUTOMOTIVE INDUSTRY
Health-hazard evaluation determination report No. 73-185-256, Electromotive-Division, GMC (Plant 2), Chicago, Illinois, 14:37186 (R;US)

AUXILIARY WATER SYSTEMS
Nuclear plant service water system aging degradation assessment: Phase 1, 14:36166 (R;US)

B

B MESONS
$B->X_s e^+e^-$ in the six-quark model, 14:37538 (J;NL)
Predictions about the decays of the B-mesons, 14:37516 (R;BR)

BACKGROUND RADIATION
Doses from natural sources of ionizing radiations and feasibilities of their restriction, 14:37658 (RA;SU;In Russian)

NRC TLD [thermoluminescent dosimeter] Direct Radiation Monitoring Network: Progress report, January–March 1989, 14:37228 (R;US)
Spectral measurements of the cosmic microwave background, 14:37441 (R;US)

BACTERIA
See also ESCHERICHIA COLI
ZYMOMONAS MOBILIS
Inhibition of respiration in activated sludge by high carbon dioxide concentration: A laboratory study, 14:36428 (R;US)
Microbial colonization on natural and artificial macrophytes in a phosphorus-limited, hardwater lake, 14:37252 (J;US)
What transposable elements do in bacteria, 14:37286 (RA;US)

BACTERIAL SPORES
Resistance of bacterial spores to ultraviolet light, 14:37339 (R;US)

BALANCE (MASS)
See MASS BALANCE

BARIUM COMPOUNDS
See also BARIUM OXIDES
^{17}O NMR study of $YBa_2Cu_3O_{7-\delta}$, 14:36641 (R;US)
Annealing and strain effects on Tl-Ba-Ca-Cu-O crystals and ceramics, 14:36647 (R;US)
Anomalous temperature dependence of Cu NMR line width and magnetization in $YBa_2Cu_3O_{7-\delta}$, 14:36642 (R;US)
Barium potassium bismuth oxide: Synthesis and physical properties, 14:36639 (R;US)
Consolidation of powders of the oxide superconductor YBa_2Cu_3Ox by high energy-high rate processing, 14:36611 (R;US)
Diamagnetic shielding and flux creep in a Tl-Ba-Ca-Cu-O thin film, 14:36584 (R;US)
High-temperature superconductivity. Quarterly report No. 1 for period ending FY89, 14:36613 (R;US)
Indoor spatial monitoring of combustion-generated pollutants (TSP, CO, and BAP) by Indian cookstoves, 14:37162 (R;US)
Nuclear relaxation rates at copper and oxygen sites in $YBa_2Cu_3O_7$, 14:36640 (R;US)
Thermal conductivity anisotropy in single crystal $YBa_2Cu_3O_{7-x}$, 14:36616 (R;US)

BARIUM OXIDES
A film transmission line resonator to measure the microwave surface resistance of $YBa_2Cu_3O_{7-x}$, 14:36901 (J;US)
A simple method for preparing superconducting high Tc thin films, 14:36956 (J;US)
Anisotropies in the magnetic penetration depth and critical current density of $R_1Ba_2Cu_3O_{7-x}$ (R = Y or Ho), measured on magnetically-aligned powder composites, 14:36952 (J;US)
Characterization of YBaCuO and ErBaCuO thin films deposited on silicon and gallium arsenide substrates, 14:36899 (J;US)
Evidence for phonon-mediated coupling in superconducting $Ba_{0.6}K_{0.4}BiO_3$, 14:36615 (R;US)
Flux noise and flux creep in YBCO thin films, 14:36897 (J;US)
Grain size control in powder processed $Y_1Ba_2Cu_3O_x$, 14:36947 (J;US)
High resolution electron microscopy of interfaces in functional materials, 14:36623 (BA;FR)
In situ growth of superconducting YBaCuO using reactive electron-beam coevaporation, 14:36955 (J;US)
Low contact-resistivity junctions to ceramic superconductors, 14:36945 (J;US)
Low frequency resistance fluctuations in films of high temperature superconductors, 14:36900 (J;US)
Phase relations in quaternary copper oxide electrodes, 14:36652 (BA;US)
RF electromagnetic investigation of an $YBa_2Cu_3O_7$ thin film by proximity coupling, 14:36902 (J;US)
X-ray absorption spectroscopy investigations of high Tc superconductors, 14:36649 (BA;US)

BARYON NUMBER 2 RESONANCES
See DIBARYONS

BASALT
Demonstration of a performance assessment methodology for high-level radioactive waste disposal in basalt formations, 14:35792 (R;US)
Surface reactions of natural glasses, 14:35821 (BA;US)

BASEMENTS
Basement condensation. Field study of new homes in Winnipeg, 14:36400 (R;CA)

BATTERIES (ELECTRIC)
See ELECTRIC BATTERIES

BEAGLES
Life-span effects of ionizing radiation in the beagle dog: A summary account of four decades of research funded by the US Department of Energy and its predecessor agencies, 14:37383 (R;US)

BEAM BUNCHING
Theoretical and numerical study of cyclotron in space charge conditions, 14:37052 (R;FR;In French)

BEAM DUMPS
Influence of a biased beam dump on H^- beam neutralization measurements with a four-grid energy analyzer, 14:37089 (R;US)

BEAM DYNAMICS
See also BEAM BUNCHING
Hardware and software complex for cyclotron beam dynamics simulation, 14:37062 (R;SU;In Russian)

BEAM EMITTANCE
The measurement of Twiss parameters using SFC's, 14:37070 (R;US)

BEAM INJECTION
See also ELECTRON BEAM INJECTION
Automatic steering corrections to minimize injection oscillations in the Fermilab Antiproton Source rings, 14:37074 (R;US)
Heavy ions beam axial injection tudy in a compact cyclotron, 14:37075 (R;FR;In French)
High-brightness electron injectors: A review, 14:37088 (R;US)
Results of experimental investigation of injector part of the LIU-30 accelerator, 14:37087 (R;SU;In Russian)

BEAM MONITORS
Beam position monitor analysis, 14:37068 (R;US)
Residual gas beam profile monitor, 14:37125 (J;NL)
Retractable carbon fibre targets for measuring beam profiles at the SLC collision point, 14:37126 (J;NL)

BEAM NEUTRALIZATION
Plugging regime in the pump limiter throat, 14:37719 (R;FR)

BEAM OPTICS
Nonlinear optical beam manipulation, beam combining, and atmospheric propagation, 14:36967 (B;US)

BEAM PERVEANCE
See BEAM EMITTANCE
SPACE CHARGE

BEAM PRODUCTION
Heavy ions beam axial injection tudy in a compact cyclotron, 14:37075 (R;FR;In French)

BEAM SEPARATORS
Production of 400 MeV/u radioactive ion beams for therapy purposes, 14:37574 (R;FR)

BEAUFORT SEA
Distribution, abundance and age segregation of bowhead whales in the southeast Beaufort Sea, August-September 1986, 14:35661 (R;CA)

BELLEFONTE-1 REACTOR
Environmental radioactivity levels Bellefonte Nuclear Plant: Annual report, 1988, 14:37232 (R;US)

BELLEFONTE-2 REACTOR
Environmental radioactivity levels Bellefonte Nuclear Plant: Annual report, 1988, 14:37232 (R;US)

BENCHMARKS
Theoretical and numerical study of cyclotron in space charge conditions, 14:37052 (R;FR;In French)

BENZENE
Containment of organic leachates from leaking underground storage tanks using tailored soils as liners, 14:37216 (R;US)
Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, January 15, 1989–April 15, 1989, 14:35553 (R;US)

BENZOFURANS
Thermal stability of jet fuel: Second quarterly report, January–March 1989, 14:35643 (R;US)

BENZOPYRROLES
See INDOLES
BERYLLIA
See BERYLLIUM OXIDES
BERYLLIUM
Trace metal removal by iron coprecipitation: Field evaluation: Final report, 14:35960 (R;US)
BERYLLIUM 7
Pasture grass interception and retention of ^{131}I, ^{7}Be, and insoluble microspheres deposited in rain, 14:37203 (R;US)
BERYLLIUM 9 TARGET
Production of 400 MeV/u radioactive ion beams for therapy purposes, 14:37574 (R;FR)
BERYLLIUM COMPLEXES
Outer-sphere hydration of metal chelates and its role in liquid-liquid partition equilibria, 14:36821 (RA;SU)
BERYLLIUM MODERATORS
See BERYLLIUM
BERYLLIUM OXIDES
Lithium beryllates and their thermodynamic properties, 14:36790 (RA;SU;In Russian)
BETA BEAMS (ELECTRONS)
See ELECTRON BEAMS
BETTIS
Effluent and environmental monitoring report for calendar year 1988, 14:37204 (R;US)
BHABHA SCATTERING
Observation of a deviation from Bhabha scattering in the electron-positron system, 14:37622 (RA;ZA)
BICRYSTALS
Molecular dynamics study of high-temperature grain-boundary stability in a (100) $\Sigma = 29$ bicrystal model, 14:37672 (BA;FR)
BINARY STARS
0535+26/HDE 245770 - a typical Be/X-ray transient system: coordinated multiwavelength twelve years monitor, 14:37434 (RA;FR)
IUE spectrophotometry of the accretion disk of HZ Her/ Her X-1, 14:37432 (RA;FR)
BIOCENOSES
See ECOSYSTEMS
BIOCONVERSION
Biofuels technical information guide, 14:35909 (R;US)
BIOGAS
See METHANE
BIOGEOCENOSES
See ECOSYSTEMS
BIOLOGICAL DOSEMETERS
Biological indicators for giving proof of exposure to ionizing radiation - lectin coupling to human blood cells possibly a 'biological dosemeter'?, 14:37376 (R;DE;In German)
BIOLOGICAL FATIGUE
Effect of Sr^{90} and ethanol on work ability in case of combined and separate action of these factors, 14:37373 (RA;SU;In Russian)
BIOLOGICAL REACTORS
See BIOREACTORS
BIOLOGY
See also RADIOBIOLOGY
1987 ILL experimental reports and theory college activities, 14:37417 (R;FR)
BIOMASS
Biofuels technical information guide, 14:35909 (R;US)
Marine biomass: New York State species and site studies. Annual report December 1982-November 1983, 14:35906 (R;US)
Theory and methodology of single tree volume estimation, 14:35907 (R;CA;In English and French)
BIOMEDICAL RADIOGRAPHY
Actual problems and basic tendencies in radiation protection of patients in X-ray diagnosis, 14:37660 (RA;SU;In Russian)
Computerized tomography: technology and equipment. January 1977-February 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1977-February 1988, 14:37323 (R;US)
Peculiarities of cytogenetic efficiency of irradiation of patients in case of various types of mammography, 14:37657 (RA;SU;In Russian)
BIOREACTORS
Microbiological investigations on nitrification in waste water treatment plants with fixed sludge beds. Pt. 2. Pilot scale test. Final report, 14:35903 (R;DE;In German)
BIOTECHNOLOGY
Bioprocessing research for energy applications, 14:35905 (R;US)
BIOTITE
Specimen cage modification for TEM in-situ shearing, 14:36693 (BA;US)
BIPHENYL
Thermodynamic equilibria in the biphenyl/hydrogen system (The power and limitations of group additivity estimations): Topical report, 14:35664 (R;US)
BIS(2-ETHYLHEXYL)PHOSPHORIC ACID
See HDEHP
BISMUTH
Approximation of precompound effects in Hauser-Feshbach codes for calculating double differential (n, xn) cross sections, 14:37637 (J;US)
Bismuth segregation in Cu-Bi bicrystals, 14:36510 (BA;FR)
BISMUTH 209 TARGET
Optical-model calculations for experimental interpretation and evaluation: Practical considerations and fundamental implications, 14:37614 (RA;XA)
BISMUTH IODIDES
Fusion phase diagram of the system BiI_3-KI, 14:36797 (RA;SU;In Russian)
Physicochemical study of the systems BiI_3-M^1I (M^1-Li, Na, K, Rb, Cs) and properties of forming compounds, 14:36796 (RA;SU;In Russian)
BISMUTH OXIDES
Barium potassium bismuth oxide: Synthesis and physical properties, 14:36639 (R;US)
Evidence for phonon-mediated coupling in superconducting $Ba_{0.6}K_{0.4}BiO_3$, 14:36615 (R;US)
BISMUTH PHOSPHATES
On the interaction of lithium and cesium phosphates of metaphosphate composition with bismuth metaphosphate, 14:36755 (RA;SU;In Russian)
BITUMENS
AOSTRA underground test facility: mining access for research and production, 14:35721 (RA;CA)
ASVAHL new routes for prosessing heavy oils, 14:35636 (RA;CA)
Comparative study of organic rich solids present in Utah and Athabasca oil sands, 14:35733 (RA;CA)
Developments in upgrading of bitumen by hydropyrolysis, 14:35706 (RA;CA)
Insolation and characterization of non-bituminous organic materials which may interfere with recovery of bitumen from oil sands, 14:35716 (RA;CA)
Investigation in the use of heavy oils (and derivatives) to process coal, 14:35518 (RA;CA)
Jet cracking. A novel coke free visbreaking process, 14:35736 (RA;CA)
Mild resid hydrocracking for heavy oil upgrading, 14:35637 (RA;CA)
Mild thermal conversion of Cold Lake bitumen, 14:35713 (RA;CA)
Selection and evaluation of diluents in the modified hot water process, 14:35718 (RA;CA)
Tar sands program plan, FY 1989, 14:35692 (R;US)
Use of small scale ART processing for wellhead viscosity reduction and upgrading of heavy oils, 14:35712 (RA;CA)
BITUMINOUS COAL
An engineering model for coal devolatilization: Quarterly report, December 15, 1988–March 15, 1989, 14:35584 (R;US)
Catalyst accessibility in high voltatile bituminous coal: Quarterly report, 14:35555 (R;US)
BLACK HOLES
Black-hole decay and topological stability in quantum gravity, 14:37426 (R;BR)

Far UV observations of black hole candidates: the case of LMC X-3, 14:37431 (RA;FR)

BLACK SHALES
Documentation and review of Eastern Gas Shales Technology. Annual report, April 1, 1984-March 31, 1985, 14:35671 (R;US)

BLACKBODY RADIATION
Gravitational lensing and finite beam-width effect on cosmic microwave anisotropies, 14:37442 (R;JP)

BLANKETS (BREEDING)
See BREEDING BLANKETS

BLASTS
See EXPLOSIONS

BLOOD
See also BLOOD CELLS
Characterization of chemically tritiated microcystin-Lr and its distribution in mouse. Interim report, 14:37328 (R;US)
Morphological content of rat peripheral blood in combined effect of radiation factors, 14:37371 (RA;SU;In Russian)
Quantitative infrared spectroscopy of glucose in blood using partial least-squares analyses, 14:37300 (R;US)

BLOOD CELLS
Biological indicators for giving proof of exposure to ionizing radiation - lectin coupling to human blood cells possibly a 'biological dosemeter'?, 14:37376 (R;DE;In German)
Retrovirus-like particles, reoviruses, and c-src expression in malignant tumors of Drosophila melanogaster, 14:37296 (RA;US)

BLUE-GREEN ALGAE
See CYANOBACTERIA

BOGS
See SWAMPS

BOHR APPROXIMATION
See NILSSON-MOTTELSON MODEL

BOHR-MOTTELSON MODEL
See NILSSON-MOTTELSON MODEL

BOILERS
See also FLUIDIZED BED BOILERS
Development of a vortex-containment combustor for coal-combustion systems. Report for January 1980-December 1983 (Final), 14:35591 (R;US)
Report on the combustion of screened duff coal in a chain-grate stoker-fired boiler, 14:35590 (R;ZA)
Wood-fired boiler feasibility study. Western Memorial Regional Hospital Corner Brook, Newfoundland, 14:35867 (RA;CA)
Woodchip conversion project report. Newfoundland Hardwoods Clarenville plant and Clarenville district vocational school, 14:35868 (RA;CA)

BOILING WATER COOLED AND MODERATED REACTOR
See BWR TYPE REACTORS

BONE TISSUES
On thorium and plutonium cocrystallization with calcium oxalate, 14:37356 (RA;SU;In Russian)

BONNEVILLE POWER ADMINISTRATION
Experiences with a large load research project in the Pacific Northwest: ELCAP [End-Use Load and Consumer Assessment Program], 14:36340 (R;US)

BOOSTERS (PARTICLE)
See PARTICLE BOOSTERS

BOREHOLES
System design for borehole heat stores, general aspects and operational experience from the store at Lulea, Sweden, 14:36201 (RA;CA;In English and French)

BORON
Determination of boron as boric acid by automatic potentiometric titration, 14:36704 (R;GB)
Electronic theory for grain boundary segregation and embrittlement of intermetallic compound Ni_3Al, 14:36518 (BA;FR)
Explorations of mechanisms regulating ectomycorrhizal colonization of boron-fertilized pine: Quarterly report, April 1,1989–June 30, 1989, 14:35901 (R;US)
Unusual segregation behavior of boron and its effect on segregation of sulfur in nickel, 14:36508 (BA;FR)

BORON ALLOYS
Electronic theory for grain boundary segregation and embrittlement of intermetallic compound Ni_3Al, 14:36518 (BA;FR)
Grain boundary structure in Ni_3Al, 14:36492 (BA;FR)
Interfaces in composites reinforced with rapidly solidified metallic ribbons, 14:36495 (BA;FR)

BORON CARBIDES
Phase transformation in boron doped SiC: HREM study of a twin interface, 14:36630 (BA;FR)

BORON COMPLEXES
Extractants for boron, 14:36836 (RA;SU)
The structure of the boron-hydrogen complex in silicon, 14:36695 (BA;US)

BOROSILICATE GLASS
A database for reviews and evaluations of high-level waste documents, 14:35820 (BA;US)

BOROSILICATES
See BOROSILICATE GLASS

BOSE-EINSTEIN GAS
Bose gas with two- and three-particle interaction: evolution of soliton-like bubbles, 14:37703 (RA;SU;In Russian)

BOUNDARIES (GRAIN)
See GRAIN BOUNDARIES

BPA
See BONNEVILLE POWER ADMINISTRATION

BRACKISH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS

BRASS
Thermal strains in a bimaterial joint: Experimental and numerical analysis, 14:36586 (R;US)

BRAZIL
Estreito field study of reservoir for the extension of steam cyclic injection pilot projects, 14:35614 (RA;CA)

BREAKWATERS
See DAMS

BREASTS
See MAMMARY GLANDS

BREEDER REACTORS
See also FBR TYPE REACTORS
Submerged gravel scrubber demonstration tests: Performance of a large-scale unit, 14:36029 (R;US)

BREEDING BLANKETS
Prospects of ceramic tritium breeder materials, 14:37754 (R;FR)

BRINES
Waste Isolation Pilot Plant brine field pH measurements: Technique and interpretation, 14:35810 (R;US)

BROMIDES
See also CADMIUM BROMIDES
CESIUM BROMIDES
MERCURY BROMIDES
X-ray fluorescence determination of bromides in cesium iodide with preliminary concentrating crystallization, 14:36712 (RA;SU;In Russian)

BRONCHOGENIC CARCINOMA
See CARCINOMAS
RESPIRATORY SYSTEM DISEASES

BROWNS FERRY-1 REACTOR
Annual radiological environmental operating report, Browns Ferry Nuclear Plant, 1988, 14:37231 (R;US)

BROWNS FERRY-2 REACTOR
Annual radiological environmental operating report, Browns Ferry Nuclear Plant, 1988, 14:37231 (R;US)

BROWNS FERRY-3 REACTOR
Annual radiological environmental operating report, Browns Ferry Nuclear Plant, 1988, 14:37231 (R;US)

BSF REACTOR
See BSR-1 REACTOR

BSR-1 REACTOR
Bulk Shielding Facility quarterly report, January, February, and March 1989, 14:36125 (R;US)

BSR-2 REACTOR
Bulk Shielding Facility quarterly report, January, February, and March 1989, 14:36125 (R;US)

BUCKLING (STRUCTURAL)
See DEFORMATION

BUILDING (CONSTRUCTING)
See CONSTRUCTION

BUILDING MATERIALS
See also CONCRETES
Formation of gamma background of building materials with additives of slags and ashes from coal thermal power plants, 14:37647 (RA;SU;In Russian)
Thermal properties of wood and wood panel products for use in buildings, 14:36378 (R;US)

BUILDINGS
See also CONTAINMENT BUILDINGS
GREENHOUSES
HOSPITALS
RESIDENTIAL BUILDINGS
SCHOOL BUILDINGS
Business guide to energy performance contracting. Final report, 14:36392 (R;US)
Energy use in buildings: The US experience and lessons for China, 14:36384 (R;US)
Radionuclide distribution in TMI-2 reactor building basement liquids and solids, 14:36193 (BA;US)
Storage of off-peak electrical energy in building floors with particular reference to resistance heating and heat pump systems, 14:36214 (RA;CA;In English and French)
Thermal energy storage: An application guide for local governments, 14:36197 (R;US)
Thermal environment evaluation, 14:36394 (R;CA;In French and English)
Thermographic inspections of building enclosures, 14:36395 (R;CA;In English and French)
[International Energy Agency third experts meeting of Annex 20 on Airflow patterns within buildings, May 30–June 2, 1989, Aalborg, Denmark; June 1, Aalborg University, Denmark; June 5-6, Taastrup, Denmark]: Foreign trip report, 14:36388 (R;US)

BUILDINGS (CONTAINMENT)
See CONTAINMENT BUILDINGS

BULK SHIELDING REACTOR-1
See BSR-1 REACTOR

BULK SHIELDING REACTOR-2
See BSR-2 REACTOR

BUNCHING (BEAM)
See BEAM BUNCHING

BURNERS
Process and system for combustion, especially of slow-reacting coal dust, 14:35589 (R;DE;In German)

BURST CAN MONITORS
See FAILED ELEMENT MONITORS

BURST SLUG MONITORS
See FAILED ELEMENT MONITORS

BUSES
Effects of road condition on the operating costs of buses, 14:36406 (R;ZA)
Effects of road-surface properties on the fuel consumption of trucks and buses, 14:36405 (R;ZA)

BUTANE
Supercritical fluid thermodynamics for coal processing: Quarterly progress report, September 15, 1988–December 31, 1988, 14:35529 (R;US)

BUTANEDIOLS
Wood sugars to energy-intensive organic chemicals: Phase 1. Final report, 14:35858 (R;US)

BUTANOLS
Separation of low molecular weight alcohols from dilute aqueous solutions by reversible chemical complexation, 14:36725 (R;US)

BUTYL ALCOHOLS
See BUTANOLS

BUTYRIC ALCOHOLS
See BUTANOLS

BWR TYPE REACTORS
See also BROWNS FERRY-1 REACTOR
BROWNS FERRY-2 REACTOR
BROWNS FERRY-3 REACTOR
DUANE ARNOLD-1 REACTOR
OYSTER CREEK-1 REACTOR
PEACH BOTTOM-3 REACTOR
SUSQUEHANNA-1 REACTOR
SUSQUEHANNA-2 REACTOR
VERMONT YANKEE REACTOR
A review of recent developments in pipe damping allowable values for United States nuclear plants, 14:35990 (R;US)
Aging degradation of BWR feedwater and main steam lines, 14:35989 (R;US)
Analysis of the CSNI/GREST core concrete interaction chemical thermodynamic benchmark exercise using the MPEC2 computer code, 14:35993 (R;JP)
Base irradiation history and interim inspection of the BWR test fuel rods of rod group BK7: The Studsvik Super-Ramp Project, 14:35997 (R;SE)
Boiling water reactor, 14:35994 (TG;US)
Closeout of IE Bulletin 80-09: Hydramotor actuator deficiencies, 14:36164 (R;US)
DOE advanced reactor severe accident program (ARSAP) - an overview, 14:36180 (BA;DE)
Effective simulator training for BWR operating crews in Japan, 14:35986 (RA;US)
Fabrication, pre-irradiation characterization and irradiation history of GE rods, for The Super-Ramp Project: The Studsvik Super-Ramp Project, 14:35998 (R;SE)
Generic safety insights for inspection of boiling water reactors, 14:36179 (BA;DE)
Modeling hydrogen water chemistry for BWR applications: Final report, 14:35991 (R;US)
Occupational dose reduction at nuclear power plants: Annotated bibliography of selected readings in radiation protection and ALARA: Volume 4, 14:36159 (R;US)
Seismic risk of a BWR, 14:36171 (BA;DE)
Stress corrosion cracking susceptibility of types 316NG and 316 stainless steel in BWR-type environments, 14:36593 (BA;US)
Test fuel rod fabrication and pre-irradiation characterization report, rod groups PK1, PK2 and BK7: Studsvik Super-Ramp Project, 14:35996 (R;SE)
The Studsvik Super-Ramp Project: Quarterly progress report, April–June, 1982, 14:35999 (R;SE)
The Studsvik Super-Ramp Project: Quarterly progress report, July–September, 1982, 14:36000 (R;SE)
Vibration monitoring of main coolant pumps: Guideline and reference data: Final report, 14:36096 (R;US)

BY-PRODUCTS
Liquid fuels from the pyrolysis of municipal solid waste and its components, 14:36442 (BA;US)
Utilization potential of coal-combustion by-products: Somerset Power Plant case study. Final report, 14:36418 (R;US)

C

C CODES
Phenomenological uncertainties in the suspended radionuclide concentrations in containment during severe LWR accidents, 14:36189 (BA;US)

C-1430 RESONANCES
See MESONS

C-REACTIVE PROTEIN
See IMMUNITY

C4 SPECIES
Plant photosynthetic pathways and grazing by phytophagous orthopterans, 14:35919 (J;US)

CABLES (ELECTRIC)
See ELECTRIC CABLES

CADMIUM
Ion exchange and soil attenuation of Gulf Coast and Great Plains soils: Final report, 14:37217 (R;US)
Trace metal removal by iron coprecipitation: Field evaluation: Final report, 14:35960 (R;US)

CADMIUM 110
Investigation of the excited O^+ states in Cd-110 and Ce-1138, 14:37624 (RA;RO;In Romanian)

CADMIUM 111
Magnetic moments of low-lying states in ^{103}Rh, ^{111,113}Cd, and ^{123,125}Te, 14:37590 (J;US)
CADMIUM 113
Magnetic moments of low-lying states in ^{103}Rh, ^{111,113}Cd, and ^{123,125}Te, 14:37590 (J;US)
CADMIUM ALLOYS
Star-disclination in a ferro-elastic material B19 MgCd alloy, 14:36543 (BA;FR)
Star-lisclination in a ferro-elastic material B19 MgCd alloy, 14:36491 (BA;FR)
CADMIUM BROMIDES
Study of interaction in ternary bromide systems of lithium, sodium, rubidium, cesium, cadmium, barium, calcium, and lead, 14:36791 (RA;SU;In Russian)
CADMIUM CHLORIDES
Complexing in ternary chloride systems of alkali metals and lead, 14:36792 (RA;SU;In Russian)
CADMIUM COMPLEXES
Extraction of zinc(2), cadmium(2), copper(2) and iron(3) by cyanex 272, 14:36840 (RA;SU)
Low-coverned nature of association (micellation) of dialkylphosphates in water and organic phases and their manifestation in the process of metal extraction with dialkylphosphoric acid (Solvent extraction of cadmium compounds.), 14:36829 (RA;SU)
Some possibilities for improvement of the extraction properties in mixed extraction systems, 14:36838 (RA;SU)
Studies on extraction of metals with 3-phenyl-4-acyl-5-isoxazolones- new series of chelating extraction (Metals: Cd, Co, Ni, etc.), 14:36835 (RA;SU)
Synergic extraction of metals with 4-acylpyrazol-5-ones and grown ethers, 14:36833 (RA;SU)
CADMIUM NITRATES
Low-melting alloys of halide and nitrate systems of alkali and alkaline earth metals and their practical use, 14:36785 (RA;SU;In Russian)
CADMIUM SULFATES
Solubility diagrams of the systems Li_2SO_4-Na_2SO_4-$MeSO_4$-H_2O (Me-Mg, Mn, Co, Ni, Cu, Zn, Cd) at 25 deg C, 14:36798 (RA;SU;In Russian)
CADMIUM TELLURIDE SOLAR CELLS
Polycrystalline cadmium telluride n-i-p solar cell: Annual subcontract report, 1 June 1987–31 August 1988, 14:35912 (R;US)
Two-terminal $CuInSe_2$-based cascade cells: Annual subcontract report, 16 January 1987–15 January 1988, 14:35911 (R;US)
CALCINATION
Evaluation of minimum-fluidizing velocity correlations for bed particles used in fluidized-bed calcination processes, 14:35816 (R;US)
CALCIUM
Aluminium dynamics in response to experimental additions of acid to a small Norwegian stream, 14:37266 (RA;NO)
CALCIUM COMPOUNDS
See also CALCIUM SULFATES
5-MW Toronto HALT [Hydrate Addition at Low Temperature] pilot plant testing: Test results: Part 1-A, 14:35958 (R;US)
Annealing and strain effects on Tl-Ba-Ca-Cu-O crystals and ceramics, 14:36647 (R;US)
Diamagnetic shielding and flux creep in a Tl-Ba-Ca-Cu-O thin film, 14:36584 (R;US)
CALCIUM FLUORIDES
Measurements of the elastic constants, the specific heat and the entropy of grain boundaries by means of ultra-fine grained materials, 14:36541 (BA;FR)
CALCIUM SULFATES
Coal ash deposition, interaction with metal substrates and deposit build up: Summary report, 26 February 1989–25 May 1989, 14:35586 (R;US)
CALDERAS
Science guide for the Long Valley Caldera deep hole, 14:37412 (R;US)
CALIFORNIA
Modeling of subsurface geology in Medicine Lake, California, 14:35939 (R;US)
Onshore federal reservoir management program and the relationship to heavy crude and tar sands in California, 14:35742 (RA;CA)
Southern California Air Quality Study: fall study. Final report, 14:37188 (R;US)
CALORIMETERS
Erratum to "hadron showers in a low-density fine-grained flash chamber calorimeter", 14:37122 (J;NL)
Sources of compensation in hadronic calorimeters, 14:37124 (J;NL)
CALORIMETERS (PARTICLE)
See SHOWER COUNTERS
CAM
See COMPUTER-AIDED MANUFACTURING
CANADA
See also ALBERTA
MANITOBA
NEWFOUNDLAND
NORTHWEST TERRITORIES
NOVA SCOTIA
ONTARIO
QUEBEC
SASKATCHEWAN
YUKON TERRITORY
An application of SPANS technology to toxic contaminant monitoring in the Atlantic region, 14:37219 (R;CA)
Canada's new free trade agreement. Energy, 14:36228 (R;CA;In English and French)
Canadian coal preparation process-control research and development directions, 14:35516 (R;CA)
Canadian energy supply and demand, 1987-2005, 14:36259 (R;CA)
Canadian energy supply and demand, 1987-2005, 14:36260 (R;CA;In French)
Community energy planner, 14:36255 (R;CA)
Comparative economic analysis of heavy oil recovery projects in China and Canada, 14:35645 (RA;CA)
Cooling with ice. Canadian progress, 14:36204 (RA;CA;In English and French)
Energy analysis of Canadian external trade, 1971 and 1976, 14:36227 (R;CA;In English and French)
Energy typologies. Energy expenditures of Canadians, 1969-1982, 14:36231 (R;CA;In French)
Reasons for descisions-TransCanada Pipelines Ltd. Requests pertaining to the installation and to the approval of the method of devising rights and of the connected questions about rates, 14:35682 (R;CA;In French)
Reporting for the domestic substances list, 14:36232 (R;CA;In French)
Small hydro in Canada, 1988, 14:35874 (RA;CA)
The regional upgrader concept for oil sand development. Brief overview, 14:35703 (RA;CA)
CANADIAN ORGANIZATIONS
CANMET Catalogue of publications, 1984/1985, 14:36240 (R;CA;In English and French)
CANMET review 1986-1987, 14:36239 (R;CA;In English and French)
CANALS (WATERWAYS)
See INLAND WATERWAYS
CANCER
See NEOPLASMS
CANDU TYPE REACTORS
Advanced instrument development: a case study. Heavy water monitors: the second generation, 14:36026 (R;CA)
Canadian contributions to the safety and environmental aspects of fusion, 14:37757 (R;CA)
Fresh fuel verification feasibility study, 14:36989 (R;CA)
CANISTERS
See CONTAINERS
CANONICAL EQUATIONS
See DIFFERENTIAL EQUATIONS
CAPACITORS
Transition metal oxide electrochemical capacitors, 14:37021 (BA;US)

CARBAMIDE
See UREA
CARBENES
[Dynamics of vibrationally excited polyatomic molecules and their unstable isomers on the electronic ground state potential surface]: Progress report, 14:36740 (R;US)
CARBINOL
See METHANOL
CARBON
See also DIAMONDS
GRAPHITE
Charged particle activation analysis of light elements, 14:36721 (RA;JP;In Japanese)
Effect of manganese on intergranular fracture in low alloy steels, 14:36537 (BA;FR)
CARBON 12
Catalytic activity in reactions of isotopic exchange of carbon monoxide and adsorption properties of catalysts on zinc oxide base, 14:36815 (RA;SU;In Russian)
CARBON 12 BEAMS
Heavy ions reactions below 100 MeV per nucleon: two contributions to the study of subthreshold pion production, 14:37601 (R;FR;In French)
CARBON 12 TARGET
$^{7}Li(p,n)^{7}Be$ and $^{12}C(p,n)^{12}N$ reactions at 200, 300, and 400 MeV, 14:37579 (J;US)
Heavy ions reactions below 100 MeV per nucleon: two contributions to the study of subthreshold pion production, 14:37601 (R;FR;In French)
Measure of back angle cross sections of antiproton-nucleus elastic scattering at 48 and 180 MeV, 14:37577 (R;FR;In French)
CARBON 13
Catalytic activity in reactions of isotopic exchange of carbon monoxide and adsorption properties of catalysts on zinc oxide base, 14:36815 (RA;SU;In Russian)
CARBON 13 TARGET
Origin of the $^{13}C + {}^{17}O$ resonant structure, 14:37576 (R;FR)
CARBON COMPLEXES
Optical reflectance studies of $C_{24}K$ and $C_{24}K(NH_3)$, 14:36696 (BA;US)
CARBON DIOXIDE
Estimates of CO_2 emissions from fossil fuel burning and cement manufacturing, based on the United Nations energy statistics and the US Bureau of Mines cement manufacturing data, 14:37173 (R;US)
Inhibition of respiration in activated sludge by high carbon dioxide concentration: A laboratory study, 14:36428 (R;US)
Secondary atomization of coal-water fuels for gas turbine applications: Final report, 14:35581 (R;US)
CARBON DIOXIDE INJECTION
Cyclic CO_2 injection for light oil recovery: Performance of a cost shared field test in Louisiana: Second quarterly report, 21 February–21 May 1989, 14:35632 (R;US)
Experimental design for non-equilibrium immiscible carbon dioxide flood, 14:35603 (RA;CA)
Heavy oil recovery through immiscible displacement by carbon dioxide, 14:35604 (RA;CA)
Steam-CO_2 injection to recover heavy oil in limestones, 14:35608 (RA;CA)
CARBON FIBERS
High resolution electron microscopy of interfaces in functional materials, 14:36623 (BA;FR)
CARBON MONOXIDE
Catalytic activity in reactions of isotopic exchange of carbon monoxide and adsorption properties of catalysts on zinc oxide base, 14:36815 (RA;SU;In Russian)
Guidance for the preparation of quality-assurance plans for O_3/CO SIP (State Implementation Plan) emission inventories. Final report, 14:37205 (R;US)
Indoor spatial monitoring of combustion-generated pollutants (TSP, CO, and BAP) by Indian cookstoves, 14:37162 (R;US)
National Performance Audit Program; ambient air audits of analytical proficiency, 1987, 14:37189 (R;US)
Structure and reactivity of chemisorbed species and reaction intermediates: Progress report, December 1, 1984–November 30, 1985, 14:36742 (R;US)
CARBON STEELS
See also STEEL-ASTM-A285
STEEL-ASTM-A516
STEEL-ASTM-A533-B
Aging degradation of BWR feedwater and main steam lines, 14:35989 (R;US)
Corrosion problems and experience at AOSTRA in-situ thermal recovery pilots, 14:36468 (RA;CA)
Installation for semiautomatic air-plasma metal cutting up to 6 mm thickness, 14:36563 (RA;SU;In Russian)
Introduction of experience of television information-control systems in welding, 14:36569 (RA;SU;In Russian)
New generation of welded semiautomatic for production of structures out of steels and aluminium alloys, 14:36566 (RA;SU;In Russian)
Nuclear waste package container corrosion in simulated salt repository environments, 14:35819 (BA;US)
CARBONACEOUS MATERIALS
See also COAL
Development of a carbonaceous selective absorber for solar thermal energy collection and process for its formation: Final report, 14:35929 (R;US)
CARBONATE MINERALS
$^{230}Th/^{234}U$ dating of the quaternary spring travertines in the Arava Rift Valley of Israel and paleoclimatic implications. Final report for the period 15 December 1986 - 15 December 1987, 14:37405 (R;XA)
CARBOXYLIC ACIDS
See also AMINO ACIDS
MONOCARBOXYLIC ACIDS
Mechanism of extraction 4th period of periodic system metal ions with carboxylic acids in sulphate systems, 14:36828 (RA;SU)
Some possibilities for improvement of the extraction properties in mixed extraction systems, 14:36838 (RA;SU)
CARCINOGENESIS
Possible role of retrotransposons in carcinogenesis, 14:37389 (RA;US)
CARCINOMAS
UW 21/123 monoclonal antibody in the radioimmunological detection of tumour tissue in the head and neck region, 14:37318 (R;DE;In German)
CARNALLITE
Pressure-dependent melting curve of natural carnallite, $KMgCl_3.6H_2O$, in a closed system, where evaporation is prevented, 14:37416 (R;DK)
CARPOOLING
Memphis Area Rideshare on-line information system, 14:36403 (R;US)
CASCADE (EXTRACTION)
See EXTRACTION COLUMNS
CASINGS (WELL)
See WELL CASINGS
CATACLYSMIC VARIABLE STARS
See ERUPTIVE VARIABLE STARS
CATALYST SUPPORTS
The role of acid-base site in the preparation of $A1_2O_3$-supported platinum catalysts, 14:36734 (RA;CA)
CATALYSTS
Changes in pore structure of precipitated iron oxide catalysts during pretreatment and hydrocarbon synthesis reaction, 14:36733 (RA;CA)
Evaluation of an on-line gas chromatographic system, 14:35545 (BA;US)
Structural and surface characterization of dispersed metal catalysts: Final report, September 1, 1986–December 31, 1988, 14:36482 (R;US)
Techniques for producing monodispersed biocatalyst beads for use in columnar bioreactors, 14:36665 (R;US)
CATALYTIC CRACKING
Reaction mechanism in VisABC process, 14:35635 (RA;CA)

CATAPHORESIS
See ELECTROPHORESIS
CATAWBA-1 REACTOR
Annual critique: an effective program evaluation tool, 14:36139 (RA;US)
CATAWBA-2 REACTOR
Annual critique: an effective program evaluation tool, 14:36139 (RA;US)
CATECHOL
See PYROCATECHOL
CATHODES
Choice of the cathode for the injector of the LIU-5/5000 linear induction accelerator, 14:37079 (RA;SU;In Russian)
Strategies for combatting problems caused by cathode slag shorting, 14:36353 (BA;US)
CAVITY RESONATORS
On the matching of accelerating channel of ion linear accelerator at high currents, 14:37056 (RA;SU;In Russian)
CEBAF ACCELERATOR
CEBAF/SURA 1984 summer workshop: Proceedings, 14:37031 (R;US)
CEBAF/SURA 1986 summer workshop: Proceedings, 14:37569 (R;US)
CEBAF/SURA [Continuous Electron Beam Accelerator Facility]/[Southeastern Universities Research Association] 1988 summer workshop: Proceedings, 14:37566 (R;US)
CEBAF/SURA [Continuous Electron Beam Accelerator Facility]/[Southeastern Universities Research Association] 1987 summer workshop: Proceedings, 14:37567 (R;US)
HUGS at CEBAF [Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility] June 6–24, 1988: Proceedings, 14:37568 (R;US)
Research program at CEBAF (II): Report of the 1986 summer Study Group, June 2–August 29, 1986, 14:37032 (R;US)
CEDARS
Cedar barrens, 14:35920 (J;US)
CELL DIFFERENTIATION
Genetics of early embryo survival, 14:37314 (R;US)
CELL DIVISION
Micronuclei: an important end-point in radiation biology, 14:37351 (RA;AU)
CELL GROWTH (ANIMAL)
See ANIMAL CELLS
CELLARS
See BASEMENTS
CELLS (ANIMAL)
See ANIMAL CELLS
CELLS (BACTERIAL)
See BACTERIA
CELLS (ELECTROLYTIC)
See ELECTROLYTIC CELLS
CELLS (REACTOR)
See REACTOR CELLS
CELLULOSE
Recycling of cellulose enzyme complex after cellulose hydrolysis. Final report, 14:35863 (R;US)
CENTRAL AMERICA
See also COSTA RICA
PANAMA
Central American resource studies, 14:36236 (R;US)
CENTRAL RECEIVERS
Cracking of Alloy 800 tubing in superheated steam sections of the solar one central receiver, 14:36591 (BA;US)
CENTRIFUGAL SEPARATORS
See INERTIAL SEPARATORS
CERAMICS
Advanced ceramics in Brazil: actual stage and perspectives, 14:36635 (R;BR;In Portuguese)
Ceramic engine parts. January 1972-April 1989 (Citations from the International Aerospace Abstracts data base). Report for January 1972-April 1989, 14:36447 (R;US)
Compact ceramic heat exchangers. Final report, February 1983-June 1988, 14:35688 (R;US)
Computer simulation of special grain boundaries in metals and ionic materials, 14:37692 (BA;US)
Diffusion reactions between silicon oxynitride and silicon nitride during HIP-synthesis, 14:36625 (BA;FR)
In situ high-temperature cross-sectional TEM specimen preparation, 14:36651 (BA;US)
Interface crack models, 14:37675 (BA;FR)
Interfaces and toughening in ceramics, 14:36619 (BA;FR)
Investigations into physicochemical properties of lithium metaaluminate ceramics, 14:36636 (RA;SU;In Russian)
Preparation of zeolites for TEM using microtomy, 14:36688 (BA;US)
Structural ceramics in the advanced materials world, 14:36473 (R;US)
Transformation toughening of ceramics. Final report, 1 September 1985-31 August 1988, 14:36612 (R;US)
Transparent glass ceramics doped by chromium(iii) and chromium(iii) and neodymium(iii) as new materials for lasers and luminescent solar concentrators. Final report, 1 October 1985-30 June 1988, 14:35928 (R;IL)
CERIUM 138
Investigation of the excited O^+ states in Cd-110 and Ce-1138, 14:37624 (RA;RO;In Romanian)
CERIUM 144
Morphological content of rat peripheral blood in combined effect of radiation factors, 14:37371 (RA;SU;In Russian)
CERIUM ALLOYS
Grain boundary internal friction and relationship to intergranular fracture, 14:36521 (BA;FR)
CERIUM COMPLEXES
Determination of thermodynamic characteristics of extraction equilibria in the systems containing ammonium salts and organic phosphorus compounds (Solvent extraction of nitrates of Ce, Pr, Eu, UO_2^{2+}, Th.), 14:36717 (RA;SU)
Equilibrium on metal extraction with substituted ammonium salts effect of non-ideality of the organic phase, 14:36861 (RA;SU)
CERIUM ISOTOPES
See also CERIUM 138
CERIUM 144
Decay of new mass-separated neutron-deficient La and Ce isotopes, 14:37581 (R;FR)
CERN II SYNCHROTRON
See CERN SPS SYNCHROTRON
CERN SPS SYNCHROTRON
Ring imaging Cherenkov detector. The DELPHI Barrel RICH Prototype. Part B: Experimental studies of the detector performance for particle identification, 14:37101 (R;FR)
CESIUM
A heat-driven monochromatic light source, 14:37751 (J;US)
Sorption of radionuclides on London clay, 14:37224 (R;GB)
Thermal properties of solid rubidium and cesium, 14:36557 (RA;SU;In Russian)
CESIUM 122
Low-spin states in ^{122}Cs, 14:37589 (R;FR)
CESIUM 137
Biological effects of ^{137}Cs, incorporated into organism of rats, 14:37367 (RA;SU;In Russian)
Dependence of animal life span shortening on dose rates in case of internal irradiation, 14:37369 (RA;SU;In Russian)
CESIUM ALLOYS
See also CESIUM BASE ALLOYS
Comparative analysis of rubidium, cesium-potassium, sodium state diagrams using photometry, 14:36549 (RA;SU;In Russian)
Evaluation of rubidium, cesium - tin, antimony state diagrams, 14:36550 (RA;SU;In Russian)
Experimental study of density of liquid cesium - sodium, potassium alloys, 14:36554 (RA;SU;In Russian)
Neutron diffraction study of crystal structure of Ge_4Na, Ge_4K, Ge_4Rb, and Ge_4Cs, 14:36548 (RA;SU;In Russian)
Neutron diffraction study of crystal structure of K_2Sn_3, Rb_2Sn_3, and Cs_2Sn_3, 14:36547 (RA;SU;In Russian)
On photometric studies of rubidium cesium - transition metal systems, 14:36551 (RA;SU;In Russian)

Relationships of structural to thermodynamic properties of sodium-cesium melts, 14:36556 (RA;SU;In Russian)
Vapor pressure over corrosion resistant alkali metal alloys, 14:36552 (RA;SU;In Russian)

CESIUM BASE ALLOYS
Experimental study of phase equilibrium of liquid - vapor for cesium - sodium, potassium alloys, 14:36553 (RA;SU;In Russian)

CESIUM BROMIDES
Cross-luminescence is a method of rare earth element electron structure investigation and physical base for subnanosecond scintillator operation, 14:37680 (RA;SU;In Russian)
Four-component system of lithium, cesium, potassium, calcium bromides, 14:36788 (RA;SU;In Russian)
Solubility of solid phases of the system $CsBr-HgBr_2-H_2O$ at 50 and 75 deg C, 14:36793 (RA;SU;In Russian)

CESIUM CHLORIDES
Complexing in ternary chloride systems of alkali metals and lead, 14:36792 (RA;SU;In Russian)
Cross-luminescence is a method of rare earth element electron structure investigation and physical base for subnanosecond scintillator operation, 14:37680 (RA;SU;In Russian)
Technology of preparation of cesium chloride and iodine from CsI(Tl) monocrystal wastes, 14:36804 (RA;SU;In Russian)

CESIUM COMPLEXES
New bis(grown ether)s as extraction agents, 14:36832 (RA;SU)

CESIUM COMPOUNDS
See also CESIUM BROMIDES
CESIUM CHLORIDES
CESIUM FLUORIDES
CESIUM IODIDES
CESIUM NITRATES
CESIUM OXIDES
CESIUM PHOSPHATES
CESIUM SULFATES
CESIUM TUNGSTATES

Absorption Spectroscopy
Atomic absorption determination of rubidium and cesium in complex objects, 14:36713 (RA;SU;In Russian)

Chemical Preparation
Double chromates of rubidium, cesium and rare earth elements, 14:36759 (RA;SU;In Russian)
Synthesis and phase transformations of double chromates of cesium rubidium and potassium with lithium, M^+LiCrO_4, 14:36758 (RA;SU;In Russian)
Synthesis and physicochemical properties of ammonium-containing fluoroaluminates of rare alkali elements, 14:36786 (RA;SU;In Russian)
Synthesis and study of some properties of mixed hexacyanoferrates (3) of rare alkali and alkaline-earth elements, 14:36789 (RA;SU;In Russian)

Chemical Reactions
Double sodium molybdates with rubidium and cesium, 14:36767 (RA;SU;In Russian)
NMR study of interactions of rare alkali metal ions (Li^+ and Cs^+) with Co^{2+} and Ni^{2+} in aqueous solutions, 14:36802 (RA;SU;In Russian)

Crystal-Phase Transformations
Synthesis and phase transformations of double chromates of cesium rubidium and potassium with lithium, M^+LiCrO_4, 14:36758 (RA;SU;In Russian)

Crystallization
Radioisotope determination of carbon impurities in cesium polyiodates, 14:36710 (RA;SU;In Russian)

Evaporation
Mass spectrometric study of evaporation of rubidium and cesium vanadates, 14:36771 (RA;SU;In Russian)

Infrared Spectra
Vibrational spectra and structure of vanadates $M_2Zn(VO_3)_4$, where M-Rb, Cs, 14:36775 (RA;SU;In Russian)

Molecular Structure
Vibrational spectra and structure of vanadates $M_2Zn(VO_3)_4$, where M-Rb, Cs, 14:36775 (RA;SU;In Russian)

Phase Diagrams
Double sodium molybdates with rubidium and cesium, 14:36767 (RA;SU;In Russian)
Effect of cesium ions on character of solubility and rare earth formate complexing processes, 14:36778 (RA;SU;In Russian)

Phase Studies
Double chromates of rubidium, cesium and rare earth elements, 14:36759 (RA;SU;In Russian)

Production
State of and trends in development of production of pure and high-pure compounds of lithium, rubidium and cesium, 14:36805 (RA;SU;In Russian)

Purification
State of and trends in development of production of pure and high-pure compounds of lithium, rubidium and cesium, 14:36805 (RA;SU;In Russian)

Pyrolysis
Synthesis and study of some properties of mixed hexacyanoferrates (3) of rare alkali and alkaline-earth elements, 14:36789 (RA;SU;In Russian)

Quantitative Chemical Analysis
Atomic absorption determination of rubidium and cesium in complex objects, 14:36713 (RA;SU;In Russian)
Radioisotope determination of carbon impurities in cesium polyiodates, 14:36710 (RA;SU;In Russian)

Solubility
Effect of cesium ions on character of solubility and rare earth formate complexing processes, 14:36778 (RA;SU;In Russian)

Sublimation Heat
Mass spectrometric study of evaporation of rubidium and cesium vanadates, 14:36771 (RA;SU;In Russian)

CESIUM FLUORIDES
Conversion methods for complex fluorides of rare alkali elements, 14:36803 (RA;SU;In Russian)
Cross-luminescence is a method of rare earth element electron structure investigation and physical base for subnanosecond scintillator operation, 14:37680 (RA;SU;In Russian)

CESIUM IODIDES
Granulation from melt of cesium iodide base compositions, 14:36808 (RA;SU;In Russian)
Preparation of cesium iodide of high purity, 14:36807 (RA;SU;In Russian)
Preparation of cesium iodide of high purity for low-background monocrystals, 14:36806 (RA;SU;In Russian)
X-ray fluorescence determination of bromides in cesium iodide with preliminary concentrating crystallization, 14:36712 (RA;SU;In Russian)

CESIUM NITRATES
On the interaction of cesium nitrate with zinc nitrate in saturated aqueous solution at 298 K, 14:36794 (RA;SU;In Russian)
Thermographic and X-ray diffraction study of binary systems based on rare alkali metal and thallium (1) nitrates and conditions of solid solution formation in them (Alkali metals: Li-Cs.), 14:36787 (RA;SU;In Russian)

CESIUM OXIDES
Thermogravimetric study of formation process and properties of cesium tantalum oxides, 14:36772 (RA;SU;In Russian)

CESIUM PHOSPHATES
Determination of specific heats of double magnesium and alkali metal orthophosphates (Alkali metals: Li-Cs.), 14:36753 (RA;SU;In Russian)
Infrared absorption spectra of rare alkali metal phosphates (Alkali metals: Li, Rb, Cs.), 14:36752 (RA;SU;In Russian)
Investigation into deep purification processes of potassium, rubidium and cesium dihydrophosphates, 14:36811 (RA;SU;In Russian)
Lithium, rubidium, and cesium cyclohexaphosphates, 14:36750 (RA;SU;In Russian)
On the compounds of rubidium, cesium and lanthanum polyphosphates, 14:36748 (RA;SU;In Russian)
On the interaction of lithium and cesium phosphates of metaphosphate composition with bismuth metaphosphate, 14:36755 (RA;SU;In Russian)

On the kinetics of dehydration of double orthophosphate hexahydrates $MgMPO_4$, 14:36749 (RA;SU;In Russian)
Properties of mixed polyphosphates of silver and rare alkali metals (Alkali metals: Li, Rb, Cs.), 14:36754 (RA;SU;In Russian)
Thermodynamic and crystallochemical features of thermal dehydration process of rubidium and cesium dihydroorthophosphates, 14:36757 (RA;SU;In Russian)

CESIUM SULFATES
Interaction of cesium, nickel and praseodymium (3) sulfates in aqueous solutions, 14:36780 (RA;SU;In Russian)

CESIUM TUNGSTATES
Synthesis and properties of double tungstates of rubidium, cesium, and titanium, 14:36765 (RA;SU;In Russian)

CFFF
See MHD GENERATOR CFFF

CHALKS
See LIMESTONE

CHARGE EXCHANGE
Excitation of the Δ resonance in heavy ion charge exchange reactions, 14:37628 (R;FR)

CHARGED PARTICLE DETECTION
AMPHORA detector, 14:37116 (R;FR)

CHARGED-PARTICLE ACTIVATION
See ACTIVATION ANALYSIS

CHARM PARTICLES
See also CHARMED MESONS
Charm physics, 14:37515 (J;US)

CHARMED MESON RESONANCES
See CHARMED MESONS

CHARMED MESONS
See also D MESONS
Charm photoproduction mechanisms and a few preliminary results from the NA 14' experiment, 14:37554 (R;FR)

CHARPY TEST
Report on the instrumented Charpy impact test for metallic materials, 14:36992 (R;JP;In Japanese)

CHARS
Coal combustion science: Quarterly progress report, January–March 1989, 14:35592 (R;US)

CHEMICAL ANALYSIS
See also ACTIVATION ANALYSIS
International conference on analytical chemistry in nuclear technology, June 5–8, 1989, Karlsruhe, France: Foreign trip report, 14:36729 (R;US)

CHEMICAL EFFLUENTS
Effluent and environmental monitoring report for calendar year 1988, 14:37204 (R;US)
Westinghouse Hanford Company 100 Areas environmental releases for 1987, 14:35812 (R;US)

CHEMICAL ENGINEERING
Frontiers in chemical engineering: Research needs and opportunities, 14:36244 (R;US)

CHEMICAL INDUSTRY
Combustion research opportunities for industrial applications: Phase II, 14:36412 (R;US)
Waste heat recovery from a sulfuric acid plant, 14:36414 (R;DE;In German)

CHEMICAL REACTIONS
See also CORROSION
FISCHER-TROPSCH SYNTHESIS
HYDROGENATION
Study of improved methods for predicting chemical equilibria: Composite technical progress report, July 1, 1986–June 30, 1989, 14:36739 (R;US)

CHEMICAL VAPOR DEPOSITION
Application of ion beams below several hundreds of electron volts. Application to thin film formation, 14:35855 (RA;JP;In Japanese)

CHEMISTRY
See also ATMOSPHERIC CHEMISTRY
GEOCHEMISTRY
PHOTOCHEMISTRY
WATER CHEMISTRY
Chemistry and Materials Science research report: Weapons-Supporting Research and Departmental Institutional Research and Development: First half FY1989, 14:37158 (R;US)
Isotopes in catalysis. Issue 147. Proceedings of the Moscow Chemical Technological Institute, 14:36702 (R;SU;In Russian)

CHEMISTRY (WATER)
See WATER CHEMISTRY

CHERENKOV COUNTERS
Ring imaging Cherenkov detector. The DELPHI Barrel RICH Prototype. Part B: Experimental studies of the detector performance for particle identification, 14:37101 (R;FR)

CHERENKOV DETECTORS
See CHERENKOV COUNTERS

CHERNOBYLSK-4 REACTOR
Chernobyl-4 accident analysis, 14:36183 (BA;DE)

CHI RESONANCES
See MESONS

CHI-2800 RESONANCES
See MESONS

CHI-3455 RESONANCES
See MESONS

CHIMNEYS
The influence of termination configuration on the flow performance of flues, 14:37024 (R;CA)

CHINA
Comparative economic analysis of heavy oil recovery projects in China and Canada, 14:35645 (RA;CA)
Paleomagnetic study of Shanwang formation, Shandong Province, China, 14:37409 (R;XA)
Proceedings of the Chinese-American symposium on energy markets and the future of energy demand, 14:36258 (R;US)
The thick-getting mechanism and characteristics of terrestrial heavy oil pools in China, 14:35599 (RA;CA)

CHLOR-ALKALI INDUSTRY
See CHEMICAL INDUSTRY
CHLORINE

CHLORIDES
See also CADMIUM CHLORIDES
CESIUM CHLORIDES
LITHIUM CHLORIDES
SODIUM CHLORIDES
STRONTIUM CHLORIDES
Evolution of the chemistry of passive films of sputter-deposited, supersaturated Al alloys. Annual report, 1 July 1987-30 November 1988, 14:36461 (R;US)

CHLORINATED AROMATIC HYDROCARBONS
Evaluating CFC [chlorofluorocarbon] alternatives from the atmospheric viewpoint: Revision 1, 14:37196 (R;US)

CHLORINE
Effects of trace gases on global atmospheric chemical and physical processes, 14:37195 (R;US)

CHLORINE 36
Complexing and catalysis in reactions of chlorine isotopic exchange between aluminium chlorides and alkylchlorides in nonaqueous solvating solvents medium, 14:36817 (RA;SU;In Russian)

CHLORINE CHLORIDES
See CHLORINE

CHLOROFORM
Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, January 15, 1989–April 15, 1989, 14:35553 (R;US)

CHROMATID DELETIONS
See CHROMOSOMAL ABERRATIONS

CHROMATOGRAPHIC COLUMNS
See EXTRACTION COLUMNS

CHROMATOGRAPHY
See also GAS CHROMATOGRAPHY
ION EXCHANGE CHROMATOGRAPHY
LIQUID COLUMN CHROMATOGRAPHY
SUPERCRITICAL FLUID CHROMATOGRAPHY
Numerical simulation of band profiles for two-component separations by displacement chromatography, 14:36732 (BA;US)

CHROMIUM
Chemistry and microstructure at metal-polymer interfaces, 14:36668 (BA;FR)
Cross-sectional TEM [transmission electron microscopy] studies of Cr films deposited by ion-assisted deposition and physical vapor deposition, 14:36472 (R;US)
Effect of chromium on early stages of oxidation of Ni_3Al alloys at 600°C, 14:36608 (J;US)
Interdiffusion of Au/Ni/Cr on silicon substrate, 14:36529 (BA;FR)
Trace metal removal by iron coprecipitation: Field evaluation: Final report, 14:35960 (R;US)

CHROMIUM 52 TARGET
Analysis of threshold reaction cross-sections and spectra of particles emitted in them on iron-group nuclei, 14:37618 (RA;XA)

CHROMIUM ALLOYS
See also CHROMIUM STEELS
NICKEL-CHROMIUM STEELS
An Auger sputter profiling study of nitrogen and oxygen ion implantation in two titanium alloys, 14:37688 (R;US)
Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1, 14:35538 (R;US)
Development of an engineering definition of the extent of J singularity controlled crack growth, 14:36579 (R;US)
Effect of Y_2O_3 additions on the plasticity of sintered Cr_2O_3, 14:36607 (J;US)
Grain boundary internal friction and relationship to intergranular fracture, 14:36521 (BA;FR)
Influence of the crystallography on the incorporation of lattice dislocations in grain boundaries, 14:36507 (BA;FR)
Studies on work-softening processes in the hot forming of austenitic steel, 14:36581 (TJ;US)
Sulfidation/oxidation properties of iron-based alloys containing niobium and aluminum, 14:35539 (R;US)
The nature and composition of the passive film formed on Ni-P-Cr metallic glasses, 14:36366 (BA;US)
[2nd international symposium on high-temperature corrosion of advanced materials and coatings, Les Embiez, France, and visit to Manchester, England, May 19–27, 1989]: Foreign trip report, 14:35536 (R;US)

CHROMIUM COMPLEXES
Study of intermediates from transition metal excited-state electron-transfer reactions: Progress report, August 1, 1986–December 31, 1988, 14:36741 (R;US)

CHROMIUM OXIDES
Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1, 14:35538 (R;US)
Effect of Y_2O_3 additions on the plasticity of sintered Cr_2O_3, 14:36607 (J;US)

CHROMIUM STEELS
On the properties of new corrosion-resistant high-strength steel 06Kh17G19N3AB and it welded joints, 14:36567 (RA;SU;In Russian)

CHROMODYNAMICS
See QUANTUM CHROMODYNAMICS

CHROMOSOMAL ABERRATIONS
Peculiarities of cytogenetic efficiency of irradiation of patients in case of various types of mammography, 14:37657 (RA;SU;In Russian)

CHROMOSOME ABERRATIONS
See CHROMOSOMAL ABERRATIONS

CHROMOSOME EXCHANGES
See CHROMOSOMAL ABERRATIONS

CHROMOSOME FRAGMENTS
See CHROMOSOMAL ABERRATIONS

CIRCUITS (ELECTRONIC)
See ELECTRONIC CIRCUITS

CIRCULAR POINT COLLECTORS
See PARABOLIC DISH COLLECTORS

CISTRONS
See GENES

CITIES
See URBAN AREAS

CLATHRATES
Staging in layer intercalates: Progress report, 1 June 1988–31 May 1989, 14:36667 (R;US)

CLAYS
Containment of organic leachates from leaking underground storage tanks using tailored soils as liners, 14:37216 (R;US)
Development of heat storage systems with vertical pipes in earth and rock, 14:36207 (RA;CA;In English and French)
Sorption of radionuclides on London clay, 14:37224 (R;GB)

CLIMATES
Backgrounder contribution No. 18: Climate scenarios for the first UC/DOE workshop, 14:37161 (R;US)

CLINTON P. ANDERSON MESON PHYSICS FACILITY
See LAMPF LINAC

CLIPPING CIRCUITS
See PULSE SHAPERS

CLOUDS
Trajectory analysis of nine years of precipitation chemistry in Charlottesville, Virginia: Final report, 14:37165 (R;US)

CO-GENERATION
See COGENERATION

CO2 FLOODING
See CARBON DIOXIDE INJECTION

COAL
See also SUBBITUMINOUS COAL

Alkylation
Solubilization of coal by reductive and non-reductive alkylation in liquid ammonia, 14:35547 (RA;CA)

Catalytic Hydrosolvation Process
Investigation in the use of heavy oils (and derivatives) to process coal, 14:35518 (RA;CA)

Chemical Properties
Correlation of stability/rheology relationship with coal properties and chemical additives: Quarterly progress report, September 15, 1988–December 15, 1988, 14:35554 (R;US)

Combustion
Coal combustion science: Quarterly progress report, January–March 1989, 14:35592 (R;US)
Detoxification and generation of useful products from coal combustion wastes: Quarterly technical report, [October–December 1988], 14:35585 (R;US)
Pyrite thermochemistry, ash agglomeration, and char fragmentation during pulverized coal combustion: Quarterly report, December 15, 1988–March 15, 1989, 14:35583 (R;US)

Combustion Chambers
Development of a vortex-containment combustor for coal-combustion systems. Report for January 1980-December 1983 (Final), 14:35591 (R;US)

Combustion Products
Cost impact of potential RCRA (Resource Conservation Recovery Act) changes on New York State Utility coal-waste disposal. Final report, 14:35563 (R;US)
Utilization potential of coal-combustion by-products: Somerset Power Plant case study. Final report, 14:36418 (R;US)

Combustion Properties
Final report on the comparative combustion properties of raw and washed Prince Mine coal, 14:35588 (R;CA)

Comminution
Coal disintegration by high-pressure waterjet: Final report, 14:35514 (R;US)

Coprocessing
A fundamental research program in coal/heavy oil coprocessing and heavy oil processing: Final report, 14:35523 (R;US)
Coal/oil coprocessing mechanism studies, 14:35546 (J;US)
Exploratory coprocessing research: Quarterly report number 2, for the period December 1, 1988 to February 28, 1989, 14:35527 (R;US)
Improved performance in co-processing through fundamental and mechanistic studies in hydrogen transfer and catalysis: Quarterly report, December 27, 1988–March 27, 1989, 14:35526 (R;US)
Low severity co-processing using homogeneous basic nitrogen promotors, 14:35641 (J;US)

Desulfurization
The selective oxidation desulfurization process: bench-scale studies: Final report, 14:35532 (R;US)
Dusts
Coal dustiness: characterization and control, 14:35549 (R;CA)
Environmental Impacts
Clean Coal Technology Demonstration Program: Draft Programmatic Environmental Impact Statement, 14:35565 (R;US)
Flotation
Testing of pyrite flotation techniques on selected Ohio coals: Final report, 14:35512 (R;US)
[Advanced froth flotation techniques]: Quarterly technical progress report No. 1, September 1, 1988–November 30, 1988, 14:35511 (R;US)
Maritime Transport
Coal traffic on the Tennessee River Waterway to year 2000, 14:35579 (R;US)
Ph Value
A preliminary pH analysis of coal slurries from the Sydney Coalfield, N.S., 14:35570 (R;CA)
Porosity
Role of porosity in supercritical fluid extraction of coal: Technical progress report, 14:35559 (R;US)
Processing
Investigation in the use of heavy oils (and derivatives) to process coal, 14:35518 (RA;CA)
Solubility
Solubilization of coal by reductive and non-reductive alkylation in liquid ammonia, 14:35547 (RA;CA)
Supply and Demand
Canadian energy supply and demand, 1987-2005, 14:36260 (R;CA;In French)
Canadian energy supply and demand, 1987-2005, 14:36259 (R;CA)
Surface Properties
Fundamental research on surface science of coal in support of physical beneficiation of coal: Quarterly technical progress report, January 1–March 31, 1989, 14:35551 (R;US)
Swelling
Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, January 15, 1989–April 15, 1989, 14:35553 (R;US)
Transport
Studies of dense phase cohesive coal transport in plugs: Quarterly report, April–June 1989, 14:35578 (R;US)
Trommels
Report on the combustion of screened duff coal in a chain-grate stoker-fired boiler, 14:35590 (R;ZA)
Wettability
Surface properties of coal and their role in coal beneficiation: Technical progress report, March 15, 1989–June 14, 1989, 14:35557 (R;US)

COAL EXTRACTS
Spectroscopic study of coal structure and reactivity: Quarterly report, January 1, 1989 to March 31, 1989, 14:35552 (R;US)

COAL FINES
Oil phase in selective agglomeration: a structural approach, 14:35515 (R;ZA)

COAL GASIFICATION
See also MOLTEN IRON PUREGAS PROCESS
Clean Coal Technology Demonstration Program: Draft Programmatic Environmental Impact Statement, 14:35565 (R;US)
Coal-test program in a pressurized, fluidized-bed ash-agglomerating process development unit. Volume 2. Data analysis. Final report, November 15, 1984-August 31, 1987, 14:35544 (R;US)
Engineering support services for the DOE/GRI coal gasification research program: Technical progress report for the period June 25–September 30, 1988, 14:35524 (R;US)

COAL GASIFICATION PLANTS
Cool Water Coal Gasification Program: Monitoring Review Committee meeting report, Washington, D.C., July 12, 1988, 14:35540 (R;US)

COAL INDUSTRY
Energy privatisation, 14:36271 (R;GB)
Why British coal should be privatised, 14:36272 (RA;GB)

COAL LIQUEFACTION
See also SASOL PROCESS
Clean Coal Technology Demonstration Program: Draft Programmatic Environmental Impact Statement, 14:35565 (R;US)
Deactivation of hydrotreatment catalysts used for coal liquids: Semi-annual report, 12 May 1988–11 November 1988, 14:35525 (R;US)
Factors controlling hydrogenolysis in coal liquefaction: Quarterly report No. 6 for the period October 1–December 31, 1987, 14:35531 (R;US)
Low severity co-processing using homogeneous basic nitrogen promotors, 14:35641 (J;US)
Phase equilibrium data for development of correlations for coal fluids: Report for the period April 15, 1989–June 15, 1989, 14:35530 (R;US)
The chemical origin of synergy in liquefaction and co-processing, 14:35521 (R;US)

COAL LIQUEFACTION PLANTS
Quick-response evaluation of energy-related occupational safety and health programs. Task Order 1: mortality study of 50 workers exposed to coal-liquefaction processes at a Union Carbide Plant, Institute, West Virginia, 14:35541 (R;US)

COAL LIQUIDS
Continuous thermodynamics and group contribution methods for coal liquids: Final report, October 1, 1986–October 1, 1989, 14:35558 (R;US)

COAL MINES
Acidification of infiltration waters as a result of the seepage through carboniferous host-rocks, 14:35566 (RA;NO)
Feasibility study of utilization of coal-mine refuse; Estill County, Kentucky, 14:35562 (R;US)
High-performance, intrinsically safe data-acquisition system for underground use. Final report, October 1984-December 1984, 14:35575 (R;US)
Radon concentrations in air of Polish underground coal mines, 14:35597 (RA;CA)
Roofbolt support in board and pillar workings, 14:35576 (R;ZA)

COAL MINING
CANMET review 1986-1987, 14:36239 (R;CA;In English and French)

COAL PREPARATION
Canadian coal preparation process-control research and development directions, 14:35516 (R;CA)

COAL SEAMS
Measurement of static coalbed-reservoir conditions for hydraulic-fracture design. Volume 2. Final report, March 1983-December 1986, 14:35681 (R;US)

COAL-DERIVED LIQUIDS
See COAL LIQUIDS

COAL-FIRED GAS TURBINES
Secondary atomization of coal-water fuels for gas turbine applications: Final report, 14:35581 (R;US)

COAL-FIRED MHD GENERATORS
See also MHD GENERATOR CDIF
MHD GENERATOR CFFF
Cold flow modeling study of coal-fired MHD combustor, 14:36360 (BA;US)
MHD bottoming cycle component testing at the coal fired flow facility - 1987, 14:36349 (BA;US)
On the nature of slag chemistry in an MHD generator, 14:36352 (BA;US)

COAL-OIL MIXTURES
See COAL
FUEL OILS
FUEL SLURRIES

COAST
See SHORES

COASTAL REGIONS
Persistent Marine Debris, challenge and response: the Federal perspective, 14:37274 (R;US)

User's guide to SDM- a Shoreline Dispersion Model, 14:37177 (R;US)

COATED FUEL PARTICLES
Study on the reaction between SiC and Pd, (2), 14:36022 (R;JP;In Japanese)

COATING (SURFACE)
See SURFACE COATING

COATING PROCESSES
See SURFACE COATING

COAXIAL CABLES
Health-hazard evaluation determination report No. 75-178-295, New York Telephone and Telegraph Company, 770 Broadway, New York, New York, 14:37183 (R;US)

COBALT
Deactivation of hydrotreatment catalysts used for coal liquids: Semi-annual report, 12 May 1988–11 November 1988, 14:35525 (R;US)
Grain boundary diffusion of Co and Ni in bicrystalline and polycrystalline NiO, 14:36633 (BA;FR)
High resolution electron energy loss studies of surface vibrations: Progress report, July 1, 1988–June 20, 1989, 14:36481 (R;US)
High resolution electron microscopy studies of the atomic structure of interfaces in magnetic sandwiches, 14:36494 (BA;FR)
Optical-model calculations for experimental interpretation and evaluation: Practical considerations and fundamental implications, 14:37614 (RA;XA)
Separation potential of solvent extraction in the recovery of metals, 14:35762 (BA;US)
Structural and surface characterization of dispersed metal catalysts: Final report, September 1, 1986–December 31, 1988, 14:36482 (R;US)

COBALT 59 TARGET
Some fundamental aspects of the optical potential for the interaction of fast neutrons with cobalt, 14:37613 (RA;XA)

COBALT ALLOYS
See also COBALT BASE ALLOYS
KOVAR
Atomic resolution observations of solute-atom segregation and two-dimensional phase transitions at internal interfaces, 14:36512 (BA;FR)

COBALT BASE ALLOYS
[2nd international symposium on high-temperature corrosion of advanced materials and coatings, Les Embiez, France, May 22–26, 1989]: Foreign trip report, 14:35537 (R;US)

COBALT COMPLEXES
Chemistry of bimetallic linked cyclopentadienyl complexes: Progress report, 1 December 1986–30 November 1989, 14:36738 (R;US)

COGENERATION
Cogeneration and competition, 14:36323 (RA;US)
Cogeneration in Europe, 14:36250 (RA;US)
Development of and outlook for cogeneration in the United States, 14:36251 (RA;US)
Feasibility of industrial coal conversion at Cornell University. Final report, 14:35542 (R;US)

COGENERATION PLANTS
See DUAL-PURPOSE POWER PLANTS

COHERENT PRODUCTION
Heavy ions reactions below 100 MeV per nucleon: two contributions to the study of subthreshold pion production, 14:37601 (R;FR;In French)

COHERENT RADIATION
Coherent VUV source at 130 nm, 14:36974 (BA;US)
Studies of collisional and nonlinear radiative processes for development of coherent uv and xuv sources. Final report, 30 September 1985-29 September 1988, 14:37463 (R;US)

COILS (MAGNETIC)
See MAGNET COILS

COKE OVENS
Determining the density distribution in a 7 metre coke oven, 14:35535 (R;XE;In German)

COLD LAKE DEPOSIT
Cold Lake artificial lift optimization, 14:35630 (RA;CA)
Geology and resources of the primrose crude bitumen deposits northeastern Alberta, 14:35696 (RA;CA)
Hydraulic fracturing improves steam placement and oil recovery, 14:35701 (RA;CA)

COLD STORAGE
An annual storage ice system for summer cooling, 14:36209 (RA;CA;In English and French)
Assessment of unitary cool storage systems: Final report, 14:36413 (R;US)
Cooling with ice. Canadian progress, 14:36204 (RA;CA;In English and French)
Ice production using ambient winter temperatures, 14:36205 (RA;CA;In English and French)
The "Fabrikaglace" process to make and store natural ice, 14:36208 (RA;CA;In English and French)

COLLECTIVE ACCELERATORS
See also ELECTRON-RING ACCELERATORS
Application of cyclotron instability for excitation of RF fields in linear accelerators, 14:37059 (RA;SU;In Russian)

COLLECTOR PROPERTIES
See PERMEABILITY

COLLECTOR PROPERTIES (ROCKS)
See PERMEABILITY

COLLEGES
See EDUCATIONAL FACILITIES

COLLIERIES
See COAL MINES

COLLISIONAL PLASMA
Dynamics of a collisional, capacitive RF sheath, 14:37753 (J;US)

COLOGNE SPIRITS
See ETHANOL

COLOR MODEL
Two-scale technicolor, 14:37539 (J;NL)

COLORADO
Characterization and implications of dickite-mineralized fractures in Mesaverde core from Piceance Creek basin, 14:35673 (J;US)
Tectonism, subsidence, and fracturing of Mesaverde reservoirs in the Piceance basin, Colorado, 14:35602 (J;US)

COLUMBIA RIVER BASIN
History of the Columbia River salmon fisheries, 14:35890 (RA;US)

COLUMBIUM
See NIOBIUM

COLUMNS (EXTRACTION)
See EXTRACTION COLUMNS

COLUMNS (MECHANICAL)
See MECHANICAL STRUCTURES

COMBINED CYCLES
Engineering support services for the DOE/GRI coal gasification research program: Technical progress report for the period June 25–September 30, 1988, 14:35524 (R;US)

COMBINED GAS AND STEAM CYCLE POWER PLANTS
See COMBINED-CYCLE POWER PLANTS

COMBINED STEAM-POWER GENERATION
See COGENERATION

COMBINED-CYCLE POWER PLANTS
A comparison of steam-injected gas turbine and combined-cycle power plants: Technology assessment: Final report, 14:35955 (R;US)
Clean Coal Technology Demonstration Program: Draft Programmatic Environmental Impact Statement, 14:35565 (R;US)
Cool Water Coal Gasification Program: Monitoring Review Committee meeting report, Washington, D.C., July 12, 1988, 14:35540 (R;US)

COMBUSTION
See also FLUIDIZED-BED COMBUSTION
IN-SITU COMBUSTION
Bifurcation and pattern formation in combustion, 14:36867 (R;US)

COMBUSTION CHAMBERS
Development of a vortex-containment combustor for coal-combustion systems. Report for January 1980-December 1983 (Final), 14:35591 (R;US)

COMBUSTION PRODUCTS
Cost impact of potential RCRA (Resource Conservation Recovery Act) changes on New York State Utility coal-waste disposal. Final report, 14:35563 (R;US)
Design guidelines for a furnace sorbent injection waste management system: Final report, 14:35959 (R;US)
Electrostatic precipitators. January 1979-April 1989 (Citations from the NTIS data base). Report for January 1979-April 1989, 14:37193 (R;US)
Leaching characteristics of incinerator residues and potential for modification of leaching, 14:36431 (R;NL)
Utilization potential of coal-combustion by-products: Somerset Power Plant case study. Final report, 14:36418 (R;US)

COMBUSTORS
See also FLUIDIZED-BED COMBUSTORS
PULSE COMBUSTORS
Development of a vortex-containment combustor for coal-combustion systems. Report for January 1980-December 1983 (Final), 14:35591 (R;US)

COMMERCE
See TRADE

COMMERCIAL SECTOR
Alternative technologies for DSM in the commercial sector, 14:36325 (RA;US)
User's manual: GCOST: A gas cost-of-service program: Version 1.0, 14:36432 (R;US)

COMMUNITIES (ECOLOGICAL)
See ECOSYSTEMS

COMPACT IGNITION TOKAMAK
Pulse length assessment of compact ignition tokamak designs, 14:37739 (R;US)
The design of a high field Ohmic heating coil for a superconducting tokamak, based on the US-DPC test coil, 14:36907 (J;US)

COMPACT TORUS
A computer model of the ZTH energy system at Los Alamos, 14:37749 (J;US)

COMPACTIFICATION
Compactification of space-time in SU(∞) Yang-Mills theory, 14:37525 (R;JP)

COMPATIBILITY (IMMUNOLOGICAL)
See IMMUNITY

COMPLEX TERRAIN
Field studies for determining the characteristics and dynamics of local circulations, 14:37164 (R;US)

COMPLEXES
See also ACTINIDE COMPLEXES
ALKALI METAL COMPLEXES
ALKALINE EARTH METAL COMPLEXES
BORON COMPLEXES
CADMIUM COMPLEXES
CARBON COMPLEXES
HYDROGEN COMPLEXES
INDIUM COMPLEXES
LITHIUM COMPLEXES
RARE EARTH COMPLEXES
TRANSITION ELEMENT COMPLEXES
Applications of inclusion in separation science, 14:35915 (BA;US)

COMPONENT COOLING SYSTEMS
See AUXILIARY WATER SYSTEMS

COMPOSITE MATERIALS
See also SUPERCONDUCTING COMPOSITES
A comprehensive guide to the literature on acoustic emission from composites: Supplement 2, 14:36994 (R;US)
Far- and mid-infrared properties of metal-insulator composite materials. Annual letter report, 1 January-31 December 1988, 14:36658 (R;US)
Preparation of in situ Cu-Nb composite sheet and wire for TEM analysis, 14:36599 (BA;US)
Preparation of thin-foil TEM specimens from sub-millimeter particulate, 14:36600 (BA;US)

COMPOUNDS (ORGANIC)
See ORGANIC COMPOUNDS

COMPUTED TOMOGRAPHY
See COMPUTERIZED TOMOGRAPHY

COMPUTER ARCHITECTURE
A virtual zero-time, monolithic systolic sorting array, 14:37798 (R;US)
Computer site threat identification and analysis, 14:37809 (R;US)
Developing software to use parallel processing effectively. Final report, June-December 1987, 14:37797 (R;US)
Expert systems on multiprocessor architectures. Phase 1. Final report, March 1985-July 1987, 14:37795 (R;US)
Lessons learned in the DOE Computer Security Enhancement Review Program, 14:37805 (R;US)
Los Alamos Center for Computer Security formal computer security model, 14:37807 (R;US)
Parallel problem-solving system, PRISM (Parallel Inference System). Final report, November 1986-February 1988, 14:37796 (R;US)
Problems and solutions in online documentation systems, 14:37815 (R;US)
Tool integration and enhancement for standard cell designs, 14:37000 (R;US)

COMPUTER CODES
See also A CODES
C CODES
E CODES
G CODES
L CODES
M CODES
O CODES
P CODES
R CODES
S CODES
T CODES
TRANSLATORS
V CODES
An alternate method for designing dipole magnet ends, 14:36923 (J;US)
MHD plasma velocity measurement using correlation techniques, 14:36359 (BA;US)
PRISIM - a plant risk status information management system for NRC inspectors, 14:36182 (BA;DE)
Thermal-hydraulic simulation of helium expulsion from a cable-in-conduit conductor, 14:36916 (J;US)

COMPUTER GRAPHICS
Using conjoint meshing primitives to generate quadrilateral and hexahedral elements in irregular regions, 14:37810 (R;US)

COMPUTER NETWORKS
Software for the communication of the BESM-6 computer complex with peripheral centers, 14:37039 (RA;SU;In Russian)

COMPUTER PROGRAMMING
See PROGRAMMING

COMPUTER PROGRAMS
See COMPUTER CODES

COMPUTER-AIDED MANUFACTURING
Computer aided process planning conceptual design and functional specification, 14:36879 (R;US)
Laser based machine for die and prototype manufacturing: Final report, February 10, 1987–August 9, 1988, 14:36870 (R;US)

COMPUTERIZED CONTROL SYSTEMS
A remote sensor/cable identifier, 14:37001 (R;US)
Bristol Babcock DPC 3330 controller evaluation, 14:36417 (R;US)

COMPUTERIZED TOMOGRAPHY
Computerized tomography: technology and equipment. January 1977-February 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1977-February 1988, 14:37323 (R;US)

CONCRETES
See also REINFORCED CONCRETE
Corrosion aggressiveness og groundwaters on the underground route in Warsaw, 14:37269 (RA;NO)
Development of air-entrained, high-strength concrete. Lightweight concrete, 14:36661 (R;CA)
Development of air-entrained, high-strength concrete. Normal weight concrete, 14:36660 (R;CA)

Some aspects of the research and development programmes on the behaviour of containments during severe accidents, 14:36131 (R;FR)
Storage of off-peak electrical energy in building floors with particular reference to resistance heating and heat pump systems, 14:36214 (RA;CA;In English and French)

CONDENSERS (ELECTRIC)
See CAPACITORS

CONDUCTIVITY (THERMAL)
See THERMAL CONDUCTIVITY

CONFERENCES
See MEETINGS

CONFORMAL GROUPS
Perturbation of c=1 conformal field theory and quantum sine-Gordon theory, 14:37557 (R;JP)

CONSERVATION (ENERGY)
See ENERGY CONSERVATION

CONSOLIDATED FUEL REPROCESSING PROGRAM
Simulation of a continuous rotary dissolver, 14:35763 (R;US)

CONSTRUCTION
Design and construction. Scientific-technical collection, 14:36872 (R;SU;In Russian)

CONTACT RADIOTHERAPY
See RADIOTHERAPY

CONTACTORS
See SWITCHES

CONTAINERS
See also PRESSURE VESSELS
REACTOR VESSELS
A wind shielded fire test facility, 14:36887 (R;US)
Nonlinear dynamic response of pressurized composite bottles subjected to shock loading, 14:36885 (R;US)
Nuclear waste package container corrosion in simulated salt repository environments, 14:35819 (BA;US)

CONTAINMENT
See also CONTAINMENT BUILDINGS
CONTAINMENT SYSTEMS
A sensitivity of aerosol agglomeration and deposition using the MAEROS model, 14:36188 (BA;US)
Effects on consequences of the high steam content in LWR accident releases, 14:36195 (BA;US)
LWR aerosol containment experiments (LACE) program and initial test results, 14:36187 (BA;US)
Phenomenological uncertainties in the suspended radionuclide concentrations in containment during severe LWR accidents, 14:36189 (BA;US)
Submerged gravel scrubber demonstration tests: Performance of a large-scale unit, 14:36029 (R;US)

CONTAINMENT BUILDINGS
A method for three-dimensional structural analysis of reinforced concrete containment, 14:36142 (R;US)
Nonlinear behavior of a containment building during an earthquake, 14:36085 (R;US)
Sensitivity/uncertainty analysis for free-in-air tissue kerma due to initial radiation at Hiroshima and Nagasaki, 14:36196 (J;US)
Some aspects of the research and development programmes on the behaviour of containments during severe accidents, 14:36131 (R;FR)
Static load cycle testing of a low-aspect-ratio six-inch wall TRG-type structure TRG-4-6 (1.0, 0.25), 14:36091 (R;US)

CONTAINMENT SYSTEMS
Submerged gravel scrubber demonstration as a passive air cleaner for containment venting and purging with sodium aerosols—CSTF tests AC7–AC10, 14:36028 (R;US)

CONTAMINATION
See also SURFACE CONTAMINATION
324 and 325 Building Hot Cell Cleanout Program: Air lock cover block refurbishment, 14:35803 (R;US)
Origin of the $^{13}C + {}^{17}O$ resonant structure, 14:37576 (R;FR)

CONTAMINATION (SURFACE)
See SURFACE CONTAMINATION

CONTENT ANALYSIS
See CHEMICAL ANALYSIS

CONTRACTOR PERSONNEL
Management of training counting beans or demonstrating results, 14:35828 (RA;US)
Managing training to maximize employee articulation, 14:35829 (RA;US)
Transferring generic SARA/OSHA training to US Department of Energy facilities, 14:35825 (RA;US)

CONTROL THEORY (REACTOR)
See REACTOR KINETICS

CONVEYORS
High-sulfur spray dryer Shawnee test program: Characterization of 10-MW spray-dryer electrostatic precipitator by-product: Final report, 14:35963 (R;US)

COOLANTS
Evaluation of SCC test methods for Inconel 600 in low-temperature aqueous solutions, 14:36175 (BA;US)

COOLERS
See HEAT EXCHANGERS

COOLING SYSTEM (REACTOR)
See REACTOR COOLING SYSTEMS

COOLING TOWER PACKING GRIDS
See PACKINGS

COOLING WATER CHEMICAL TREATMENT
See WATER CHEMISTRY

COORDINATED RESEARCH PROGRAMS
See also CONSOLIDATED FUEL REPROCESSING PROGRAM
Tenth working group meeting of representatives of RCA Member States. Report, 14:37788 (R;XA)

COPPER
Atmospheric corrosion and inhibition of copper, 14:36595 (BA;US)
Bismuth segregation in Cu-Bi bicrystals, 14:36510 (BA;FR)
Chemistry and microstructure at metal-polymer interfaces, 14:36668 (BA;FR)
Cu-AlN interface: electronic structure and adhesion, 14:36542 (BA;FR)
Dependence of diffusion-induced grain boundary migration on grain boundary structure, 14:36527 (BA;FR)
Free energy calculation via MD: methodology and application to bicrystals, 14:36499 (BA;FR)
High resolution electron energy loss studies of surface vibrations: Progress report, July 1, 1988–June 20, 1989, 14:36481 (R;US)
Normal state resistance and low temperature magnetoresistance of superconducting cables for accelerator magnets, 14:36946 (J;US)
Polycrystal plasticity as applied to the problem of in-plane anisotropy in rolled cubic metals, 14:36572 (R;US)
Resonant charge-exchange studies with hyperthermal-energy ion beams: development of multi-detection capabilities and a data acquisition system. Final report, 15 November 1986-14 May 1988, 14:37460 (R;US)
Separation potential of solvent extraction in the recovery of metals, 14:35762 (BA;US)
Special mechanical properties of very thin films, 14:36538 (BA;FR)
Structure of small angle tilt boundaries and their behavior under the applied shear stresses in fcc metals, 14:36531 (BA;FR)
Survey of results from Brookhaven Experiment 802 at the AGS, 14:37596 (R;US)
TEM study of diffusion-induced grain boundary migration in Ni-Cu diffusion couples, 14:36530 (BA;FR)
Trace metal removal by iron coprecipitation: Field evaluation: Final report, 14:35960 (R;US)

COPPER 63
Anomalous temperature dependence of Cu NMR line width and magnetization in $YBa_2Cu_3O_{7-\delta}$, 14:36642 (R;US)

COPPER ADDITIONS
Corrosion of high-density sintered tungsten alloys. Part 1. Immersion testing, 14:36463 (R;AU)
Corrosion of high-density sintered tungsten alloys. Part 2. Accelerated corrosion testing, 14:36464 (R;AU)

COPPER ALLOYS
See also COPPER ADDITIONS
COPPER BASE ALLOYS
MONEL 400
Development of an engineering definition of the extent of J singularity controlled crack growth, 14:36579 (R;US)
Effect of grain-boundary structure on stress corrosion cracking in αCu-Al alloy bicrystals, 14:36536 (BA;FR)
Preparation of in situ Cu-Nb composite sheet and wire for TEM analysis, 14:36599 (BA;US)
TEM determination of incoherent twin-boundary structure in $L1_2$ ordered alloys, 14:36497 (BA;FR)

COPPER BASE ALLOYS
See also BRASS
A database for reviews and evaluations of high-level waste documents, 14:35820 (BA;US)

COPPER COMPOUNDS
See also COPPER OXIDES
CUPRATES
Consolidation of powders of the oxide superconductor YBa_2Cu_3Ox by high energy-high rate processing, 14:36611 (R;US)
High-temperature superconductivity. Quarterly report No. 1 for period ending FY89, 14:36613 (R;US)
Impedance spectroscopy for the study of anodic copper dissolution in sulfuric acid in presence of benzotriazole, 14:36367 (BA;US)
Josephson effect research in high-temperature superconductors. Interim report, 30 September 1987-29 September 1988, 14:36609 (R;US)

COPPER OXIDES
Absorption Spectra
X-ray absorption spectroscopy investigations of high Tc superconductors, 14:36649 (BA;US)
Annealing
Annealing and strain effects on Tl-Ba-Ca-Cu-O crystals and ceramics, 14:36647 (R;US)
Critical Current
Anisotropies in the magnetic penetration depth and critical current density of $R_1Ba_2Cu_3O_{7-x}$ (R = Y or Ho), measured on magnetically-aligned powder composites, 14:36952 (J;US)
Electrochemistry
Phase relations in quaternary copper oxide electrodes, 14:36652 (BA;US)
Interfaces
High resolution electron microscopy of interfaces in functional materials, 14:36623 (BA;FR)
Magnetic Shielding
Diamagnetic shielding and flux creep in a Tl-Ba-Ca-Cu-O thin film, 14:36584 (R;US)
Microstructure
Flux noise and flux creep in YBCO thin films, 14:36897 (J;US)
Nuclear Magnetic Resonance
^{17}O NMR study of $YBa_2Cu_3O_{7-\delta}$, 14:36641 (R;US)
Anomalous temperature dependence of Cu NMR line width and magnetization in $YBa_2Cu_3O_{7-\delta}$, 14:36642 (R;US)
Nuclear relaxation rates at copper and oxygen sites in $YBa_2Cu_3O_7$, 14:36640 (R;US)
Pairing Energy
Pairing in CuO_2 driven by exchange interactions between carriers and localized Cu spins, 14:37476 (R;US)
Phase Studies
Grain size control in powder processed $Y_1Ba_2Cu_3O_x$, 14:36947 (J;US)
Superconducting Films
Characterization of YBaCuO and ErBaCuO thin films deposited on silicon and gallium arsenide substrates, 14:36899 (J;US)
In situ growth of superconducting YBaCuO using reactive electron-beam coevaporation, 14:36955 (J;US)
Low frequency resistance fluctuations in films of high temperature superconductors, 14:36900 (J;US)
RF electromagnetic investigation of an $YBa_2Cu_3O_7$ thin film by proximity coupling, 14:36902 (J;US)
Superconducting Junctions
Low contact-resistivity junctions to ceramic superconductors, 14:36945 (J;US)
Superconductivity
A film transmission line resonator to measure the microwave surface resistance of $YBa_2Cu_3O_{7-x}$, 14:36901 (J;US)
A simple method for preparing superconducting high Tc thin films, 14:36956 (J;US)
Thermal Conductivity
Thermal conductivity anisotropy in single crystal $YBa_2Cu_3O_{7-x}$, 14:36616 (R;US)

COPPER SELENIDE SOLAR CELLS
Materials analysis and device optimization of $CuInSe_2$ solar cells: Annual subcontract report, 16 January 1987–15 January 1988, 14:35913 (R;US)
Two-terminal $CuInSe_2$-based cascade cells: Annual subcontract report, 16 January 1987–15 January 1988, 14:35911 (R;US)

COPPER VAPOR LASERS
See GAS LASERS

COPROCESSING
A fundamental research program in coal/heavy oil coprocessing and heavy oil processing: Final report, 14:35523 (R;US)
Bibliography of CANMET publications on coprocessing, 14:35533 (R;CA)
Coal/oil coprocessing mechanism studies, 14:35546 (J;US)
Improved performance in co-processing through fundamental and mechanistic studies in hydrogen transfer and catalysis: Quarterly report, December 27, 1988–March 27, 1989, 14:35526 (R;US)
The chemical origin of synergy in liquefaction and coprocessing, 14:35521 (R;US)

CORES (REACTOR)
See REACTOR CORES

CORN (MAIZE)
See MAIZE

CORN STOVER
See MAIZE

CORROSION
See also PITTING CORROSION
Effect of acidification on structures in soil and water, 14:37268 (RA;NO)
Impedance spectroscopy for the study of anodic copper dissolution in sulfuric acid in presence of benzotriazole, 14:36367 (BA;US)
[2nd international symposium on high-temperature corrosion of advanced materials and coatings, Les Embiez, France, May 22–26, 1989]: Foreign trip report, 14:35537 (R;US)
[2nd international symposium on high-temperature corrosion of advanced materials and coatings, Les Embiez, France, and visit to Manchester, England, May 19–27, 1989]: Foreign trip report, 14:35536 (R;US)

CORROSION INHIBITORS
Corrosion inhibition in sour media, 14:36469 (R;CA)

CORROSION PRODUCTS
Development of HPLC techniques for the analysis of trace-metal species in the primary coolant of a pressurized-water reactor, 14:36015 (D;GB)

CORROSION RESISTANT ALLOYS
Aspects of alloy selection in thermal recovery of heavy crudes and tar sands, 14:36467 (RA;CA)
Corrosion of high-density sintered tungsten alloys. Part 1. Immersion testing, 14:36463 (R;AU)
Materials tests in support of MHD steam bottoming plant, 14:36357 (BA;US)

COSMIC DUST
Synchrotron x-ray fluorescence analyses of stratospheric cosmic dust: New results for chondritic and nickel-depleted particles, 14:37425 (R;US)

COSMIC PARTICLES
See COSMIC RADIATION

COSMIC RADIATION
Risk assessment and late effects of radiation in low-earth orbits, 14:37343 (R;US)

COSMIC RADIO SOURCES
See also SUPERNOVA REMNANTS
Millimeter wavelength observations of SS 433 and its environs, 14:37446 (J;US)
COSMIC X-RAY SOURCES
0535+26/HDE 245770 - a typical Be/X-ray transient system: coordinated multiwavelength twelve years monitor, 14:37434 (RA;FR)
IUE and optical observations of X-ray sources in the LMC, 14:37435 (RA;FR)
COSMOGONY
See COSMOLOGY
COSMOLOGICAL CONSTANT
The cosmological constant problem, 14:37438 (R;US)
COSMOLOGICAL MODELS
See also INFLATIONARY UNIVERSE
Gauge invariant cosmological perturbations with cold dark matter, 14:37530 (R;JP)
COSMOLOGY
Introduction to gravity and cosmology, 14:37439 (R;FR)
Wormholes and the cosmological constant, 14:37711 (J;NL)
COSMOS
See UNIVERSE
COST
See also OPERATING COST
Office of the Inspector General: Semiannual report, October 1, 1988–March 31, 1989, 14:37793 (R;US)
The value of marginal analysis in electric power system operations, 14:36274 (R;US)
User's manual: GCOST: A gas cost-of-service program: Version 1.0, 14:36432 (R;US)
COSTA RICA
Canopy photography for assessment of local light environment of tropical forest trees and palms, 14:35918 (J;US)
Economics of selected energy applications of peat in Panama and Costa Rica, 14:35595 (R;US)
COUNTERS (RADIATION)
See RADIATION DETECTORS
COUPLINGS (MACHINE PARTS)
See MACHINE PARTS
CP INVARIANCE
BNL workshop on rare K decays and CP violation, August 25-27, 1988, 14:37497 (R;US)
Enhanced CP violations in hadronic charm decays, 14:37542 (J;NL)
First evidence for direct cp violation, 14:37544 (R;FR)
CRABS
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic): Blue crab, 14:37249 (R;US)
CRACK GROWTH
See CRACK PROPAGATION
CRACK PROPAGATION
Development of an engineering definition of the extent of J singularity controlled crack growth, 14:36579 (R;US)
CRACKS
Interface crack models, 14:37675 (BA;FR)
CRANES
Non-standard means of mechanization for auxiliary and repair operations, 14:36873 (RA;SU;In Russian)
CRATERS
Centrifuge tests on simulation of the "cookie cutter" mechanism of chimney collapse into underground openings: Final report, 14:37159 (R;US)
CRAY COMPUTERS
Cray-to-sun prototype, 14:37814 (R;US)
CREEKS
See STREAMS
CREEP
Recent advances in modelling creep crack growth. Proceedings, 14:36545 (R;DE)
CRITICAL GROUP (ICRP)
See ICRP CRITICAL GROUP
CRITICAL HEAT FLUX
Critical heat flux (CHF) characteristics of high conversion pressurized water reactor with double flat core, 14:36010 (R;JP;In Japanese)
CRITICALITY ACCIDENTS
See RADIATION ACCIDENTS
CRNL MP TANDEM ACCELERATOR
Shape coexistence at high spin in ^{187}Au, 14:37593 (R;FR)
CRNL SUPERCONDUCTING CYCLOTRON
Magnetic field decay in model SSC dipoles, 14:36913 (J;US)
CROPS
Toxicology of ozone. April 1988-April 1989 (Citations from the NTIS data base). Report for April 1988-April 1989, 14:37394 (R;US)
Toxicology of ozone. January 1970-March 1988 (Citations from the NTIS data base). Report for January 1970-March 1988, 14:37393 (R;US)
CROSS-LINKING
Methods for studying effects of high-energy irradiation on the mechanical and electric properties of polymers, 14:36655 (R;TR)
CROWN ETHERS
See POLYETHYLENE GLYCOLS
CRUDE OIL
See PETROLEUM
CRYOPUMPS
Hydrogen isotopes effect on efficiency of helium cryosorption pumping out by argon condensed layers, 14:36877 (RA;SU;In Russian)
CRYOSTATS
Superconducting super collider second generation dipole magnet cryostat design, 14:36922 (J;US)
CRYSTAL DOPING
Low-energy ion shower doping and its application for electronic devices, 14:35854 (RA;JP;In Japanese)
CRYSTAL MODELS
What underlies the Anderson Hamiltonian?, 14:37696 (BA;US)
CRYSTALLOGRAPHY
1987 ILL experimental reports and theory college activities, 14:37417 (R;FR)
CRYSTALS
See also IONIC CRYSTALS
POLYCRYSTALS
The response of single crystal and polycrystal nickel to quasistatic and shock deformation, 14:36573 (R;US)
CUPRATES
Consolidation of powders of the oxide superconductor YBa_2Cu_3Ox by high energy-high rate processing, 14:36611 (R;US)
High-temperature superconductivity. Quarterly report No. 1 for period ending FY89, 14:36613 (R;US)
Josephson effect research in high-temperature superconductors. Interim report, 30 September 1987-29 September 1988, 14:36609 (R;US)
CURING
The effective utilization of differential scanning calorimetry (DSC) to assess molded parts, 14:36678 (R;US)
CURRENT ALGEBRA
Relations between Virasoro algebra and Krichever-Novikov algebra on a torus, 14:37556 (R;JP)
CUTTING MACHINES
Proposal for the development of a computerized guidance system for the Easi-Miner continuous mining machine, 14:35571 (R;CA)
Statistical analysis of collected times between failure and times to repair of Easi-Miner at Obed Mine, 14:35569 (R;CA)
CYANIDES
Induction of VL30 element expression as a response to anoxic stress, 14:37388 (RA;US)
CYANOBACTERIA
Microbial colonization on natural and artificial macrophytes in a phosphorus-limited, hardwater lake, 14:37252 (J;US)

CYCLOHEXANE
Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, January 15, 1989–April 15, 1989, 14:35553 (R;US)
Thermodynamic equilibria in the biphenyl/hydrogen system (The power and limitations of group additivity estimations): Topical report, 14:35664 (R;US)
CYCLOTRONS
[Twelfth international conference on cyclotrons and their applications, Berlin, W. Germany, and visit to Hahn-Meitner-Institute, May 8–12, 1989]: Foreign trip report, 14:37044 (R;US)
CYTOCHROMES
Respiratory enzymes of Thiobacillus ferrooxidans: Progress report, March 1988–July 1989, 14:37325 (R;US)

D

D MESONS
Enhanced CP violations in hadronic charm decays, 14:37542 (J;NL)
D PLUS RESONANCES
See D MESONS
D RESONANCES
See CHARMED MESONS
D-1865 RESONANCES
See D MESONS
DAMPERS (GAS FLOW)
See DRAFT CONTROL SYSTEMS
DAMS
Measurement of upwelling flow from Upper Bear Creek reservoir air diffusers, 14:35899 (R;US)
Pilot program for water quality data collection by volunteers, 14:35898 (R;US)
Results of fisheries investigations in Douglas tailwater, August 1987–September 1988, 14:35897 (R;US)
DAPHNIA
Determinants of Daphnia clonal diversity in lakes, 14:37277 (J;US)
DATA ACQUISITION SYSTEMS
A microprocessor farm architecture for high speed data acquisition and analysis, 14:37103 (R;US)
A remote sensor/cable identifier, 14:37001 (R;US)
High-performance, intrinsically safe data-acquisition system for underground use. Final report, October 1984-December 1984, 14:35575 (R;US)
Neural networks for event filtering at Dv, 14:37106 (R;US)
DATA BASE MANAGEMENT
A database for reviews and evaluations of high-level waste documents, 14:35820 (BA;US)
Analysis of existing advanced data models and their applicability as a model for a multimedia data-base management system. Master's thesis, 14:37817 (R;US)
Approaching distributed database applications using a programmable terminal emulator, 14:37819 (R;US)
Managing data from a large-scale groundwater monitoring program, 14:37255 (R;US)
DATA FORMS
Analysis of existing advanced data models and their applicability as a model for a multimedia data-base management system. Master's thesis, 14:37817 (R;US)
DATA PROCESSING
See also TASK SCHEDULING
Experimental data processing techniques by a personal computer, 14:37804 (R;JP;In Japanese)
Inclusion of correlations in the empirical selection of intranuclear cascade nucleons from high energy hadron-nucleus collisions, 14:37127 (J;NL)
DATA STORAGE DEVICES
See MEMORY DEVICES
DATA TRANSMISSION
Communication techniques for safely transmitting and verifying unique signals, 14:37157 (R;US)
TRACE - Tamper Resistant Authenticated Camera Enclosure, 14:36890 (R;US)
DATING
See AGE ESTIMATION
DBP
Low-coverned nature of association (micellation) of dialkylphosphates in water and organic phases and their manifestation in the process of metal extraction with dialkylphosphoric acid (Solvent extraction of cadmium compounds.), 14:36829 (RA;SU)
DEAD SEA
$^{230}Th/^{234}U$ dating of the quaternary spring travertines in the Arava Rift Valley of Israel and paleoclimatic implications. Final report for the period 15 December 1986 - 15 December 1987, 14:37405 (R;XA)
DEBRIS (NUCLEAR)
See FISSION PRODUCTS
DECONTAMINATION
Removal of airborne thoron (radon) daughters on mine walls and other surfaces by convective deposition and electrostatic plate-out, 14:35833 (RA;CA)
DECONTAMINATION FACTOR
See DECONTAMINATION
DEFENSE
See NATIONAL DEFENSE
DEFENSE ATOMIC SUPPORT AGENCY TRIGA-MK-F
See AFRRI REACTOR
DEFORMATION
See also NUCLEAR DEFORMATION
DYNA3D user's manual: (Nonlinear dynamic analysis of structures in three dimensions): Revision 5, 14:36893 (R;US)
DEFORMED NUCLEI
Fifty years of nuclear fission: Nuclear data and measurements series, 14:37560 (R;US)
DEGRADATION (RADIOINDUCED)
See RADIOLYSIS
DELAYED GAMMA RADIATION
Formulation and solution of the delayed gamma dose rate problem using the concept of effective delayed gamma production cross section, 14:37772 (R;US)
DELAYED RADIATION INJURIES
See RADIATION INJURIES
DELETIONS (CHROMOSOMAL)
See CHROMOSOMAL ABERRATIONS
DELTA RESONANCES (MESON)
See MESONS
DEMONSTRATION PROGRAMS
[Discussions with International Energy Agency's Center for the Analysis and Dissemination of Demonstrated Energy Technologies concerned with database and analysis study series of reports, Sittard, Netherlands, May 22–26, 1989]: Foreign trip report, 14:37821 (R;US)
[Weatherization assistance program]: Annual report, 14:36379 (R;US)
DENSITY
Determining the density distribution in a 7 metre coke oven, 14:35535 (R;XE;In German)
DENSITY (ELECTRON)
See ELECTRON DENSITY
DENSITY (ENERGY)
See ENERGY DENSITY
DENSITY (PLASMA)
See PLASMA DENSITY
DEOXYPENTOSE NUCLEIC ACID
See DNA
DEOXYRIBONUCLEIC ACID
See DNA
DEPTH DOSE DISTRIBUTIONS
Calculated and measured depth dose profiles in a phantom exposed to neutron radiation fields, 14:37662 (R;US)
DEPTH DOSES
See DEPTH DOSE DISTRIBUTIONS

DERMATITIS
Health-hazard evaluation determination report No. 74-78-297, Amax Speciality Metals, Parkersburg, West Virginia, 14:37185 (R;US)
DESERTRON
See SUPERCONDUCTING SUPER COLLIDER
DESOXYRIBONUCLEIC ACID
See DNA
DESTRUCTIVE TESTING
See also CHARPY TEST
The Sigmajig: An improved hot-cracking test, 14:36479 (R;US)
DETECTION
Capillary zone electrophoresis-mass spectrometry of peptides and proteins, 14:37141 (R;US)
DETECTORS (RADIATION)
See RADIATION DETECTORS
DETONATIONS
Numerical simulation of the simultaneous detonation of two identical, fully contained explosions, 14:37151 (R;US)
DEUTERIUM
An efficient palladium isotope chromatograph (EPIC) for hydrogen, 14:36727 (R;US)
Catalytic properties of hydride-forming intermetallic compounds in reactions with the participation of hydrogen, 14:36814 (RA;SU;In Russian)
Low-temperature isotopic exchange in molecular hydrogen on films of transition and rare earth metals and their alloys with copper, 14:36813 (RA;SU;In Russian)
DEUTERIUM TARGET
Development of a polarized deuterium target to measure T_{20} in electron storage rings, 14:37572 (R;US)
DEUTERIUM-LITHIUM HIGH FLUX NEUTRON SOURCE FACILITY
See NEUTRON SOURCE FACILITIES
DEUTERON BEAMS
Reconstruction project for accelerating structure of small-size deuteron linear accelerator, 14:37037 (RA;SU;In Russian)
Selective population of the highest spin n-p states in heavy nuclei via the (α, d) reaction at 218 MeV, 14:37588 (R;FR)
DEUTERON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET
DEVONIAN SHALES
See BLACK SHALES
DEXTRIN
Applications of inclusion in separation science, 14:35915 (BA;US)
DI-2-ETHYLHEXYLPHOSPHORIC ACID
See HDEHP
DIABETES MELLITUS
Quantitative infrared spectroscopy of glucose in blood using partial least-squares analyses, 14:37300 (R;US)
DIABLO CANYON-1 REACTOR
Evolution of technician and maintenance training, 14:36004 (RA;US)
Research in operations: lessons learned, 14:36134 (RA;US)
DIABLO CANYON-2 REACTOR
Evolution of technician and maintenance training, 14:36004 (RA;US)
Research in operations: lessons learned, 14:36134 (RA;US)
DIAMONDS
TDPAD measurements of implantation temperature dependance in ^{19}F implanted diamond, 14:37677 (RA;ZA)
DIAPHRAGMS (THERMONUCLEAR DEVICE)
See LIMITERS
DIATOMS
Microbial colonization on natural and artificial macrophytes in a phosphorus-limited, hardwater lake, 14:37252 (J;US)
DIBARYON RESONANCES
See DIBARYONS
DIBARYONS
Molecular picture for dibaryons, 14:37523 (RA;RO;In Romanian)
New results on narrow dibaryns produced in np-ppPI$^-$ at 1.25 Gev/c, 14:37520 (RA;RO;In Romanian)
DIBUTYL PHOSPHATE
See DBP
DICHLOROMETHANE
See METHYLENE CHLORIDE
DIELECTRIC TRACK DETECTORS
Equipment and methodical complex for measuring integral volumetrical activity of radon and its fission products, 14:37659 (RA;SU;In Russian)
DIESEL ENGINES
Effect of a diesel blend containing heavy naphtha on the performance and durability of an ADE 236 diesel engine operating with standard-injection timing, 14:36446 (R;ZA)
Effect of a light-diesel blend formulated by BP on the performance and durability of an ADE 314 diesel engine, 14:36445 (R;ZA)
Engine operation on extended diesel fuels, 14:36444 (R;ZA)
Laboratory evaluation of MIL-T-83133 JP-8 fuel in army diesel engines. Interim report, October 1984-January 1988, 14:35666 (R;US)
NMERI (National Mechanical Engineering Research Institute) experience with alcohol fuels for diesel engines, 14:36451 (R;ZA)
Software development for a microprocessor based controller for ac-dc-ac diesel-electric freight locomotive power unit control, 14:36443 (R;CA)
Waste heat recovery in remote communities. A shared opportunity, 14:35953 (R;CA)
DIESEL FUELS
Effect of a diesel blend containing heavy naphtha on the performance and durability of an ADE 236 diesel engine operating with standard-injection timing, 14:36446 (R;ZA)
Effect of a light-diesel blend formulated by BP on the performance and durability of an ADE 314 diesel engine, 14:36445 (R;ZA)
Engine operation on extended diesel fuels, 14:36444 (R;ZA)
NMERI (National Mechanical Engineering Research Institute) experience with alcohol fuels for diesel engines, 14:36451 (R;ZA)
DIESEL OIL (FRACTION)
See DIESEL FUELS
DIFFERENTIAL EQUATIONS
Asynchronous integration of ordinary differential equations on multiprocessors, 14:37802 (R;US)
DIFFRACTION (X-RAY)
See X-RAY DIFFRACTION
DIFFUSION
Configurational diffusion of coal macromolecules: Quarterly progress report, March 16–June 15, 1989, 14:35556 (R;US)
DIGESTER GAS
See METHANE
1,2-DIHYDROXYBENZENE
See PYROCATECHOL
DIHYDROXYBENZENE-ORTHO
See PYROCATECHOL
DIMETHYL KETONE
See ACETONE
DIMETHYLBENZENES
See XYLENES
DIODE TRANSISTORS
See TRANSISTORS
DIODES (SEMICONDUCTOR)
See SEMICONDUCTOR DIODES
DIPHENYLPHOSPHINE OXIDE
See ORGANIC PHOSPHORUS COMPOUNDS
DIRAC EQUATION
Klein's paradox and the relativistic point interaction, 14:37710 (R;DE)
DIRECTIONAL CORRELATION
See ANGULAR CORRELATION
DIRECTIONAL DRILLING
Calculating the maximum horizontal wellbore length, 14:35700 (RA;CA)
Horizontal well application in the Pelican Lake and winter reservoirs, 14:35631 (RA;CA)
DISCHARGES (IONIZATION)
See IONIZATION
DISCHARGES (WASTES)
See WASTE DISPOSAL
DISINTEGRATION (FISSION)
See FISSION

DISLOCATIONS
See also SCREW DISLOCATIONS
Dynamic studies of deformation and fracture at grain boundaries, 14:36533 (BA;FR)
Mobility of dislocations in grain boundaries, 14:37673 (BA;FR)
Molecular statics studies of grain boundaries: structure and energy of (001) twist boundaries, 14:37665 (BA;FR)
DISPOSAL (WASTES)
See WASTE DISPOSAL
DISSOLVED OXYGEN
See OXYGEN
DISTILLATES
Structural definition of synthetic fuels, Wilsonville I, 14:35560 (R;US)
DISTRICT HEATING
See also SOLAR DISTRICT HEATING
Open cycle heat pump development: Phase II, District heating case study analysis: Progress report, October 1988–December 31, 1988, 14:36424 (R;US)
Seasonal storage of heat for district heating in Sweden, 14:36206 (RA;CA;In English and French)
The borehole heat store at Lulea, Sweden, 14:36213 (RA;CA;In English and French)
DISTRICT OF COLUMBIA
See WASHINGTON DC
DNA
See also RECOMBINANT DNA
A soliton mechanism for DNA melting: Progress report, November 1, 1988–October 31, 1989, 14:37298 (R;US)
DNA biosynthesis content and intensiveness in mice thymus at early periods following fast neutron irradiation with different energy rate, 14:37379 (RA;SU;In Russian)
Functional potential of the human LINE-1 family of interspersed repeats, 14:37288 (RA;US)
Inducible cellular responses to DNA damage, 14:37387 (RA;US)
Possible role of retrotransposons in carcinogenesis, 14:37389 (RA;US)
Role of the bacterial host in the mechanism and regulation of Tn10 transposition, 14:37304 (RA;US)
DNA POLYMERASES
Structural studies of Klenow fragment: an enzyme with two active sites, 14:37297 (BA;US)
DNA REPAIR
DNA exchange in mice spleen at early periods following fast neutron irradiation with different energy rate, 14:37378 (RA;SU;In Russian)
Inducible cellular responses to DNA damage, 14:37387 (RA;US)
Intensity of DNA synthesis in immuno-competent organs of animals in early periods after neutron irradiation with different energy values, 14:37377 (R;SU;In Russian)
DOMESTIC SUPPLIES
Oil use and oil dependency: Long-term issues, 14:35654 (R;US)
DOMESTIC WASTES
See MUNICIPAL WASTES
DOPING (CRYSTAL)
See CRYSTAL DOPING
DORMITORIES
See RESIDENTIAL BUILDINGS
DOSE DISTRIBUTIONS
See RADIATION DOSE DISTRIBUTIONS
DOSE EQUIVALENTS
324 and 325 Building Hot Cell Cleanout Program: Air lock cover block refurbishment, 14:35803 (R;US)
Annual radiological environmental operating report, Sequoyah Nuclear Plant, 1988, 14:37230 (R;US)
Systems analysis, long-term radionuclide transport, and dose assessments, Waste Isolation Pilot Plant (WIPP), southeastern New Mexico; March 1989, 14:35811 (R;US)
DOSE RATES
Risk assessment and late effects of radiation in low-earth orbits, 14:37343 (R;US)
DOSEMETERS
See also BIOLOGICAL DOSEMETERS
Calibration and testing of the DMG gamma dosimeter, 14:37111 (RA;SU;In Russian)
High-dose intercomparison study involving red 4034 perspex and radiochromic dye films, 14:37100 (R;GB)
DOSIMETERS
See DOSEMETERS
DOUBLE BETA DECAY
Research in nuclear physics at low and intermediate energies, neutrinos and x rays: Final report, May 1980–August 1987, 14:37563 (R;US)
DOW PUSHER 700
See POLYAMIDES
DOWTHERM
See BIPHENYL
DPO
See ORGANIC PHOSPHORUS COMPOUNDS
DRAFT CONTROL SYSTEMS
The influence of termination configuration on the flow performance of flues, 14:37024 (R;CA)
DRAG
Proposals for improving interphase drag modelling for the bubbly and slug regimes in RELAP5, 14:36001 (R;GB)
DRAG COEFFICIENT
See DRAG
DRAG EFFECT
See ELECTROPHORESIS
DRIFT (PLASMA)
See PLASMA DRIFT
DRILL BITS
PDC [polycrystalline diamond compact] bit research at Sandia National Laboratories, 14:35943 (R;US)
DRILL HOLES
See BOREHOLES
DRILL PIPES
Calculating the maximum horizontal wellbore length, 14:35700 (RA;CA)
In search of more output: Two strain gage bridge circuits revisited, 14:37135 (R;US)
DRILLING FLUIDS
Handling and disposal of waste drilling fluids from on-land sumps in the Northwest Territories and Yukon, 14:35660 (R;CA)
DRILLING MUD
See DRILLING FLUIDS
DROSOPHILA
Concerted transposition in Drosophila melanogaster, 14:37307 (RA;US)
Evidence of host-mediated regulation of retroviral element expression at the posttranscriptional level, 14:37312 (RA;US)
Mobile DNA elements and spontaneous gene mutation, 14:37305 (RA;US)
Molecular basis of transposable element-induced mutations in Drosophila melanogaster, 14:37308 (RA;US)
Regulatory aspects of the expression of P-M hybrid dysgenesis in Drosophila, 14:37294 (RA;US)
Retrovirus-like particles, reoviruses, and c-src expression in malignant tumors of Drosophila melanogaster, 14:37296 (RA;US)
Structure of mutations induced by I-R hybrid dysgenesis in Drosophila melanogaster, 14:37311 (RA;US)
Transposons as probes of regulatory machinery, 14:37291 (RA;US)
DRUG ABUSE
Fitness for duty in the nuclear power industry: A review of technical issues, 14:36162 (R;US)
Fitness for duty in the nuclear power industry: Responses to public comments, 14:36052 (R;US)
DRYERS
Testing of hair dryers for asbestos emissions, 14:37180 (R;US)
DTO
See TRITIUM COMPOUNDS
DUAL-PURPOSE POWER PLANTS
Decentral dual-purpose power plants, 14:36344 (R;DK;In Danish)
DUANE ARNOLD-1 REACTOR
Personnel development program (an enhancement to GET), 14:36138 (RA;US)

DUSTS
See also COSMIC DUST
Characterization of radioactive long-lived dust present in uranium mines and mills atmospheres, 14:35750 (RA;CA)
Coal dustiness: characterization and control, 14:35549 (R;CA)
Further studies of respiratory health of wool textile workers. Final report, October 1986-July 1988, 14:37191 (R;GB)
Hazards of explosives dusts, 14:37150 (R;US)
Preliminary survey report: control technology support for sensor, Unimin Corporation, Dividing Creek Sand Plant, Millville, New Jersey, August 16, 1988, 14:37179 (R;US)
Recreating the uranium mining environment of the 1950's, 14:35751 (RA;CA)
Release of dispersed asbestos fibres from soils, 14:37190 (R;GB)
DYE LASERS
Laser action from syn-(methyl,methyl) bimane, 14:36958 (R;US)
Sideband generation in saturated pulsed dye amplifiers with multiple cw single mode injection, 14:36969 (BA;US)
DYMAC SYSTEM
See NUCLEAR MATERIALS MANAGEMENT
PLUTONIUM
DYNAMIC MATERIALS ACCOUNTABILITY SYSTEM
See NUCLEAR MATERIALS MANAGEMENT
PLUTONIUM
DYNAMICS (BEAM)
See BEAM DYNAMICS
DYSPROSIUM 152
On the feeding and spectroscopy of superdeformed states, 14:37635 (R;SE)
DYSPROSIUM 156
Neutron emission and nuclear spin distribution in 4n and 5n exit channels of the ^{156}Dy compound nucleus, 14:37586 (R;FR)
DYSPROSIUM 161 TARGET
Collective structures in ^{185}Hg, 14:37591 (R;FR)
DYSPROSIUM 165
Intensive two-quantum cascades and fragmentation of quasiparticle states in some deformed nuclei, 14:37633 (R;SU;In Russian)
DYSPROSIUM COMPOUNDS
See also DYSPROSIUM OXIDES
High-temperature superconductivity. Quarterly report No. 1 for period ending FY89, 14:36613 (R;US)
DYSPROSIUM OXIDES
Investigation of the lanthanide sesquioxides as high temperature transformation toughening agents, 14:36648 (B;US)

E

E CODES
ECIS - Adaptation to CDC CYBER system, 14:37801 (R;BR;In Portuguese)
ELLIPSE user's manual and program reference, 14:37811 (R;US)
E LAYER
See E REGION
E REGION
Investigation of the production of nitric oxide by soft solar x rays in the e-region of the ionosphere. Master's thesis, 14:37449 (R;US)
EARLY RADIATION INJURIES
See RADIATION INJURIES
EARTH ATMOSPHERE
See also EARTH MAGNETOSPHERE
IONOSPHERE
THERMOSPHERE
Effects on consequences of the high steam content in LWR accident releases, 14:36195 (BA;US)
EARTH MAGNETOSPHERE
See also MAGNETOTAIL
On field line resonances of hydromagnetic Alfven waves in dipole magnetic field, 14:37458 (R;US)
Snapshots of high-latitude electrodynamics using Viking and DMSP f7 observations, 14:37447 (R;US)
Theoretical modeling of plasma waves in the magnetosphere. Final report, 1 October 1982-30 September 1988, 14:37451 (R;US)
EARTH PLANET
Comparative analysis of broad-scale landscape patterns, 14:37211 (J;US)
EARTHMOVING EQUIPMENT
The selection, development and testing of an integrated truck/shovel management system, 14:35573 (R;CA)
EBFA
See ELECTRON BEAM FUSION ACCELERATOR
ECOLOGICAL COMMUNITIES
See ECOSYSTEMS
ECOLOGY
Comparative analysis of broad-scale landscape patterns, 14:37211 (J;US)
Mitigation studies, 14:37246 (RA;NO)
Prediction models for acidification, 14:37270 (RA;NO)
ECOSYSTEMS
See also AQUATIC ECOSYSTEMS
TERRESTRIAL ECOSYSTEMS
Priorities for the next decade of research in radiation ecology, 14:37385 (J;US)
EDUCATIONAL FACILITIES
See also SCHOOL BUILDINGS
Feasibility of industrial coal conversion at Cornell University. Final report, 14:35542 (R;US)
EFFLUENTS (CHEMICAL)
See CHEMICAL EFFLUENTS
EFFLUENTS (LIQUID)
See LIQUID WASTES
EFFLUENTS (RADIOACTIVE)
See RADIOACTIVE EFFLUENTS
EFFLUENTS (THERMAL)
See THERMAL EFFLUENTS
EFFUSION
See DIFFUSION
EINSTEIN GRAVITATION THEORY
See GENERAL RELATIVITY THEORY
EINSTEIN-DE SITTER MODEL
See COSMOLOGICAL MODELS
EINSTEINIUM 251
Mass-split dependence of the pre- and post-scission neutron multiplicities for fission of ^{251}Es, 14:37607 (R;AU)
ELECTRIC APPLIANCES
Testing of hair dryers for asbestos emissions, 14:37180 (R;US)
ELECTRIC BATTERIES
See also LEAD-ACID BATTERIES
Electrode materials and processes for energy conversion and storage, 14:36223 (B;US)
Introduction to lithium batteries. General document, 14:36220 (R;AU)
Investigation of polymeric solid-electrolyte cells, carried out during a nominal three-year period, focused on the rechargeable lithium battery. Final report, 15 July 1985-30 October 1988, 14:36219 (R;US)
Phase relations in quaternary copper oxide electrodes, 14:36652 (BA;US)
ELECTRIC CABLES
See also COAXIAL CABLES
SUPERCONDUCTING CABLES
Cyclic loading for distribution cables in duct banks, Vol. 4, 14:35970 (R;CA)
Water treeing as a function of moisture present in XLPE cable insulation, 14:35968 (R;CA)
ELECTRIC CONDENSERS
See CAPACITORS
ELECTRIC CONTACTORS
See SWITCHES
ELECTRIC FIELDS
Electrically stabilized expanded beds for sorption separations, 14:36706 (R;US)
Enhanced flame stability and soot radiation using electric fields. Annual report, July 1987-July 1988, 14:35687 (R;US)

Non-linear optical interactions involving the real Gaussian field: Annual technical progress report, August 1, 1986–July 31, 1989, 14:37134 (R;US)

ELECTRIC POWER
See also HYDROELECTRIC POWER

Cost
Electricity - raw material, 14:36317 (RA;US)
Taking charge of electricity costs, 14:36318 (RA;US)

Marginal-Cost Pricing
Competitive pricing and regulatory reform, 14:36282 (RA;US)
Forecasting day-ahead marginal costs, 14:36286 (RA;US)
Marginal cost pricing in France, 14:36336 (RA;US)
Marginal operating costs: is system lambda enough?, 14:36281 (RA;US)
New dimensions in marginal cost concepts, 14:36279 (RA;US)
Validating marginal cost estimates, 14:36287 (RA;US)

Power Generation
Hybrid power system studied, 14:35956 (J;US)

Prices
Alternative rate design in the United States, 14:36332 (RA;US)
Alternative technologies for DSM in the commercial sector, 14:36325 (RA;US)
Assessing the value of service reliability, 14:36292 (RA;US)
Attributes of simplicity in pricing, 14:36322 (RA;US)
Cogeneration and competition, 14:36323 (RA;US)
Competition and bypass in regulated markets, 14:36289 (RA;US)
Cost-based pricing in the United States, 14:36335 (RA;US)
Customer outage costs: their role in system planning and pricing, 14:36280 (RA;US)
Customer response to real-time pricing, 14:36301 (RA;US)
Demand charge: does it fit in?, 14:36296 (RA;US)
Demand-side management in the Federal Republic of Germany, 14:36329 (RA;US)
Derivation of service values from surveys, 14:36293 (RA;US)
Discussion on planning and DSM, 14:36331 (RA;US)
Discussion on planning and pricing, 14:36337 (RA;US)
Efficiency vs. fairness retail pricing, 14:36310 (RA;US)
Electricity pricing: a new role for an old concept, 14:36278 (RA;US)
Estimating outage costs from demand analysis, 14:36294 (RA;US)
Exploring new dimensions in RTP, 14:36302 (RA;US)
From rates to prices: the emerging concepts, 14:36277 (RA;US)
GPU's experience with curtailable loads, 14:36309 (RA;US)
Guaranteed rates: a marketable option?, 14:36321 (RA;US)
Importance of market segmentation in new service and rate offerings, 14:36314 (RA;US)
Incentives for residential direct load control, 14:36307 (RA;US)
Influencing customer investment through financial incentives, 14:36316 (RA;US)
Innovative pricing of electricity, 14:36276 (RA;US)
Innovative pricing: do benefits outweigh costs?, 14:36297 (RA;US)
Institutional aspects of DSM in France, 14:36327 (RA;US)
Institutional aspects of DSM in Italy, 14:36328 (RA;US)
Institutional aspects of DSM in the United States, 14:36330 (RA;US)
Introduction: demand-side management – a fundamental part of utility planning, 14:36324 (RA;US)
Large industry's view of innovative pricing, 14:36319 (RA;US)
Market segmentation and pricing for competitive markets, 14:36311 (RA;US)
Marketing rates that enhance net revenue, 14:36313 (RA;US)
Measuring outage probabilities, 14:36288 (RA;US)
Modifying process operations in response to innovative pricing, 14:36305 (RA;US)
Motivations for and evolution of DSM, 14:36326 (RA;US)
Options for broadcasting price & information, 14:36299 (RA;US)
Price differentiation by time and by service, 14:36283 (RA;US)
Pricing electric power and services in a dynamic marketplace, 14:36275 (RA;US)
Pricing innovation and latent technology development: the chicken and egg syndrome, 14:36304 (RA;US)
Pros and cons of negotiated rates, 14:36290 (RA;US)
Rate manager's perespective: theory to practice, 14:36308 (RA;US)
Rate manager's perspective: theory to practice, 14:36285 (RA;US)
Regulatory perspective on interruptible rates, 14:36312 (RA;US)
Revenue and rates of return requirements, 14:36295 (RA;US)
Strategic integration of pricing and demand-side management, 14:36284 (RA;US)
Strategies to meet increased competition, 14:36291 (RA;US)
Tariffs used for load management in Europe, 14:36333 (RA;US)
Technological requirements for new pricing strategies, 14:36298 (RA;US)
Two-part pricing in real-time, 14:36303 (RA;US)
Using variable prices to improve productivity, 14:36306 (RA;US)
Working systems from off-the-shelf components, 14:36300 (RA;US)

Quality Control
Power quality: a utility perspective, 14:36320 (RA;US)

Time-Of-Use Pricing
Comparison of time-of-use rate impacts, 14:36334 (RA;US)
Effects of voluntary TOU rates on revenues, 14:36315 (RA;US)

ELECTRIC SWITCHES
See SWITCHES

ELECTRIC UTILITIES

Automation
Information and automation technology: Serving electric utility customers in the 1990s: Conference proceedings, 14:36257 (R;US)

Competition
Cogeneration and competition, 14:36323 (RA;US)

Cost
The value of marginal analysis in electric power system operations, 14:36274 (R;US)

Fossil-Fuel Power Plants
Cost impact of potential RCRA (Resource Conservation Recovery Act) changes on New York State Utility coal-waste disposal. Final report, 14:35563 (R;US)

Income
Marketing rates that enhance net revenue, 14:36313 (RA;US)

Information Systems
Information processing at N.B. Power, 14:37824 (RA;CA)

Load Management
Alternative rate design in the United States, 14:36332 (RA;US)
Alternative technologies for DSM in the commercial sector, 14:36325 (RA;US)
Assessing the value of service reliability, 14:36292 (RA;US)
Attributes of simplicity in pricing, 14:36322 (RA;US)
Comparison of time-of-use rate impacts, 14:36334 (RA;US)
Competition and bypass in regulated markets, 14:36289 (RA;US)
Competitive pricing and regulatory reform, 14:36282 (RA;US)
Cost-based pricing in the United States, 14:36335 (RA;US)
Customer outage costs: their role in system planning and pricing, 14:36280 (RA;US)
Customer response to real-time pricing, 14:36301 (RA;US)
Demand charge: does it fit in?, 14:36296 (RA;US)
Demand-side management in the Federal Republic of Germany, 14:36329 (RA;US)
Derivation of service values from surveys, 14:36293 (RA;US)
Discussion on planning and DSM, 14:36331 (RA;US)
Effects of voluntary TOU rates on revenues, 14:36315 (RA;US)
Efficiency vs. fairness retail pricing, 14:36310 (RA;US)
Electricity pricing: a new role for an old concept, 14:36278 (RA;US)
Estimating outage costs from demand analysis, 14:36294 (RA;US)
Experiences with a large load research project in the Pacific Northwest: ELCAP [End-Use Load and Consumer Assessment Program], 14:36340 (R;US)
Exploring new dimensions in RTP, 14:36302 (RA;US)
Forecasting day-ahead marginal costs, 14:36286 (RA;US)
From rates to prices: the emerging concepts, 14:36277 (RA;US)
GPU's experience with curtailable loads, 14:36309 (RA;US)
Guaranteed rates: a marketable option?, 14:36321 (RA;US)

Importance of market segmentation in new service and rate offerings, 14:36314 (RA;US)
Incentives for residential direct load control, 14:36307 (RA;US)
Influencing customer investment through financial incentives, 14:36316 (RA;US)
Innovative pricing of electricity, 14:36276 (RA;US)
Innovative pricing: do benefits outweigh costs?, 14:36297 (RA;US)
Institutional aspects of DSM in France, 14:36327 (RA;US)
Institutional aspects of DSM in Italy, 14:36328 (RA;US)
Institutional aspects of DSM in the United States, 14:36330 (RA;US)
Introduction: demand-side management – a fundamental part of utility planning, 14:36324 (RA;US)
Large industry's view of innovative pricing, 14:36319 (RA;US)
Marginal cost pricing in France, 14:36336 (RA;US)
Marginal operating costs: is system lambda enough?, 14:36281 (RA;US)
Market segmentation and pricing for competitive markets, 14:36311 (RA;US)
Marketing rates that enhance net revenue, 14:36313 (RA;US)
Measuring outage probabilities, 14:36288 (RA;US)
Modifying process operations in response to innovative pricing, 14:36305 (RA;US)
Motivations for and evolution of DSM, 14:36326 (RA;US)
New dimensions in marginal cost concepts, 14:36279 (RA;US)
Options for broadcasting price & information, 14:36299 (RA;US)
Power quality: a utility perspective, 14:36320 (RA;US)
Price differentiation by time and by service, 14:36283 (RA;US)
Pricing electric power and services in a dynamic marketplace, 14:36275 (RA;US)
Pricing innovation and latent technology development: the chicken and egg syndrome, 14:36304 (RA;US)
Pros and cons of negotiated rates, 14:36290 (RA;US)
Rate manager's perespective: theory to practice, 14:36308 (RA;US)
Rate manager's perspective: theory to practice, 14:36285 (RA;US)
Regulatory perspective on interruptible rates, 14:36312 (RA;US)
Revenue and rates of return requirements, 14:36295 (RA;US)
Strategic integration of pricing and demand-side management, 14:36284 (RA;US)
Strategies to meet increased competition, 14:36291 (RA;US)
Tariffs used for load management in Europe, 14:36333 (RA;US)
Technological requirements for new pricing strategies, 14:36298 (RA;US)
Two-part pricing in real-time, 14:36303 (RA;US)
Using variable prices to improve productivity, 14:36306 (RA;US)
Validating marginal cost estimates, 14:36287 (RA;US)
Working systems from off-the-shelf components, 14:36300 (RA;US)

Monitoring
Review of environmental monitoring equipment for air, water and soil systems. Vol. 2(iii)-Equipment data sheets. Record #529-586, user and utility information records, 14:35964 (R;CA)

Ownership
Energy privatisation, 14:36271 (R;GB)

Planning
Discussion on planning and pricing, 14:36337 (RA;US)
Effects of voluntary TOU rates on revenues, 14:36315 (RA;US)
Introduction: demand-side management – a fundamental part of utility planning, 14:36324 (RA;US)

Rate Structure
Manitoba Hydro application for an order requesting a general rate review and approval of certain rate adjustments effective April 1, 1989, 14:36339 (R;CA)

ELECTRICAL BREAKDOWN
See ELECTRICAL FAULTS

ELECTRICAL FAULTS
Power line fault probabilities, 14:35971 (R;CA)

ELECTRICAL INSULATION
Determination of the nature and content of antioxidant and antioxidant synergist in PE and XLPE used in cables, 14:36728 (R;CA)
Effects of insulation on potted superconducting coils, 14:36917 (J;US)
Water treeing as a function of moisture present in XLPE cable insulation, 14:35968 (R;CA)

ELECTRICAL INSULATORS
Vacuum insulator failure measurements and improvement, 14:37019 (R;US)

ELECTRODEPOSITED COATINGS
Developments and trends in electrodeposition, 14:36605 (J;US)

ELECTRODEPOSITION
Developments and trends in electrodeposition, 14:36605 (J;US)

ELECTRODES
See also ANODES
CATHODES
Composition and structure of the passive oxide film on iron as observed by second harmonic generation, 14:36650 (BA;US)
Electrode materials and processes for energy conversion and storage, 14:36223 (B;US)
Measurements of the structure and dynamics of thin film growth on electrode surfaces by SHG, 14:36369 (BA;US)
The influence of surface capacitance on the measurements of localized corrosion transients, 14:36368 (BA;US)

ELECTROLYTE TILES
See MATRIX MATERIALS

ELECTROLYTES
See also SOLID ELECTROLYTES
Improved acid electrolytes for fuel cells. Final report, July 1985-January 1989, 14:36364 (R;US)
Improved acid electrolytes: synthesis and structure of fluorine-containing sulfonic acids for fuel cells. Final report, July 1987-August 1988, 14:36363 (R;US)

ELECTROLYTIC CELLS
Electrode-induced beta battery degradation. Final report, 14:36222 (R;US)
Electrorefining cell evaluation, 14:35758 (R;US)
Investigation of polymeric solid-electrolyte cells, carried out during a nominal three-year period, focused on the rechargeable lithium battery. Final report, 15 July 1985-30 October 1988, 14:36219 (R;US)

ELECTROMAGNETIC FIELDS
Electromagnetic wave scattering on the jump of the waveguide cross section, 14:37058 (RA;SU;In Russian)

ELECTROMAGNETIC TRANSITIONS
See ENERGY-LEVEL TRANSITIONS

ELECTROMIGRATION
See ELECTROPHORESIS

ELECTRON ACCEPTOR
See ELECTRONS

ELECTRON BEAM FUSION ACCELERATOR
CEBAF, a large scale application of superconducting rf, 14:36896 (J;US)

ELECTRON BEAM INJECTION
Application of cyclotron instability for excitation of RF fields in linear accelerators, 14:37059 (RA;SU;In Russian)

ELECTRON BEAM WELDING
Introduction of experience of television information-control systems in welding, 14:36569 (RA;SU;In Russian)

ELECTRON BEAMS
Effect of high-frequency energy recuperation on the intense electron beam acceleration dynamics, 14:37055 (RA;SU;In Russian)
Modeling of the proposed ATA fast correction coils, 14:37046 (R;US)
On the acceleration of relativistic electron beam over dielectrical grid, 14:37061 (RA;SU;In Russian)
Optimization of particle dynamics in accelerating installation with account of the excitation of resonator by a beam, 14:37060 (RA;SU;In Russian)

ELECTRON DENSITY
Electron-density profiles and plasma-drift measurements with digital ionosondes. Technical report, July 1987-June 1988, 14:37452 (R;US)

ELECTRON DONOR
See ELECTRONS

ELECTRON GUNS
Electron injector for high-voltage model of collective accelerator, 14:37078 (RA;SU;In Russian)
ELECTRON NEUTRINOS
Neutrino mass experiments, 14:37511 (R;US)
ELECTRON SPECTROMETERS
CEBAF superconducting spectrometer design, 14:36934 (J;US)
ELECTRON TRANSFER
Superexchange coupling mechanisms for electron transfer processes, 14:36735 (R;US)
ELECTRON-POSITRON INTERACTIONS
Search for resonant Bhabha scattering at MeV energies, 14:37507 (R;DE)
ELECTRON-RING ACCELERATORS
A superconducting dipole concept for the CEBAF high resolution spectrometers, 14:36943 (J;US)
A superconducting toroidal magnet for the CEBAF large acceptance spectrometer, 14:36942 (J;US)
CEBAF superconducting spectrometer design, 14:36934 (J;US)
ELECTRONIC CIRCUITS
See also PRINTED CIRCUITS
A symbolic generator of state equations for modeling of dynamic systems based on the electrical network analog paradigm, 14:37014 (R;US)
Developing software to use parallel processing effectively. Final report, June-December 1987, 14:37797 (R;US)
LineCAP [Line/Circuit Analysis Program]: Cross-coupling on PC [printed circuit] board traces including discontinuities and circuit elements, 14:37015 (R;US)
Transition metal oxide electrochemical capacitors, 14:37021 (BA;US)
ELECTRONIC DATA PROCESSING
See DATA PROCESSING
ELECTRONIC EQUIPMENT
See also MICROWAVE EQUIPMENT
POWER SUPPLIES
A probabilistic method for estimating system susceptibility to HPM, 14:37131 (R;US)
ELECTRONS
An overview of atomic and molecular processes in critical velocity ionization, 14:37750 (J;US)
Electron localization in one-dimensional incommensurate potentials, 14:37694 (BA;US)
Physics of spin-polarized atomic vapors. Final report, 1 October 1986-30 April 1988, 14:37461 (R;US)
ELECTROPHORESIS
Optimization of separation efficiency in capillary zone electrophoresis, 14:36731 (BA;US)
The on-line combination of capillary isotachophoresis with mass spectrometry, 14:37142 (R;US)
ELECTROSTATIC ACCELERATORS
See also VAN DE GRAAFF ACCELERATORS
Generator of a high-power microsecond REB, 14:37721 (RA;SU;In Russian)
Numerical simulation of plasma-filled diode gap with magnetic insulation, 14:37057 (RA;SU;In Russian)
Safety guide of the Tandar accelerator, 14:37640 (R;AR;In Spanish)
ELECTROSTATIC LENSES
Gabor lens focusing of a negative ion beam, 14:37051 (R;US)
ELECTROSTATIC PRECIPITATORS
10-MW spray dryer/ESP pilot plant test program: High-sulfur coal test phase (phase 3): Final report, 14:35962 (R;US)
Electrostatic precipitators. January 1979-April 1989 (Citations from the NTIS data base). Report for January 1979-April 1989, 14:37193 (R;US)
ELECTROSTATIC WAVES
See PLASMA WAVES
ELEMENTS
See also METALS
TRANSURANIUM ELEMENTS
Size distribution patterns for trace elements in waters draining a small catchment, S.E. Norway, 14:37263 (RA;NO)
ELLIOT LAKE
Recreating the uranium mining environment of the 1950's, 14:35751 (RA;CA)
ELLIPSOMETRY
ELLIPSE user's manual and program reference, 14:37811 (R;US)
EMBRYOS
Genetics of early embryo survival, 14:37314 (R;US)
EMERGENCY PLANS
1988 DOE model conference proceedings: Volume 2, 14:35772 (R;US)
Chemical and nuclear emergencies: Interchanging lessons learned from planning and accident experience, 14:37344 (R;US)
Crisis management program for senior officials, 14:35830 (RA;US)
EMERGENCY PROVISIONS
See EMERGENCY PLANS
EMITTANCE (BEAM)
See BEAM EMITTANCE
EMPLOYEES
See PERSONNEL
EMULSIONS
"Slip effects" in concentrated emulsions, 14:37132 (R;CA)
ENDANGERED SPECIES
Preliminary assessment of habitat protection needs for West Indian manatees on the east coast of Florida and Georgia. Final report, 14:37284 (R;US)
The occurrence and status of candidate species listed by the US Fish and Wildlife Service on Naval Petroleum Reserve No. 1, Kern County, California, 14:37207 (R;US)
ENDONUCLEASES
Regulatory aspects of the expression of P-M hybrid dysgenesis in Drosophila, 14:37294 (RA;US)
ENDOSTEUM
See BONE TISSUES
ENERGY ABSORPTION
Radial distributions of energy deposited along charged particle tracks, 14:37663 (R;US)
ENERGY ANALYSIS
Performance monitoring protocols, 14:36393 (R;US)
ENERGY CONSERVATION
Conservation and Renewable Energy Program bibliography, 1989 Edition, 14:36370 (R;US)
Energy Task Force status report for first quarter year ten, 14:36253 (R;US)
Technology selection criteria and methodology for prioritizing energy research and development programs. Final report, 14:36252 (R;US)
User's guide to CONVEST, 14:37803 (R;US)
ENERGY CONSUMPTION
Retention and expansion program for high-energy use and cost-intensive business, 14:36429 (R;US)
ENERGY CONVERSION
Review of second law analysis techniques applicable to the Energy Conversion and Utilization Technologies Thermal Sciences Program, 14:36226 (R;US)
ENERGY DEMAND
DRI (Data Resources Inc.) Energy Model/GRI (Gas Research Institute) Hydrocarbon Model and IFCAM linkage. Final report, December 1984, 14:36268 (R;US)
DRI (Data Resources Inc.) Energy Model/GRI (Gas Research Institute) Hydrocarbon Model and IFCAM linkage. Final report, September 1983, 14:36265 (R;US)
GRI (Gas Research Institute) 1983 baseline project forecast methodology and assumptions. Final report, November 1983, 14:36264 (R;US)
GRI (Gas Research Institute) 1983 baseline projection forecast summary. Final report, 14:36263 (R;US)
GRI (Gas Research Institute) 1984 baseline project forecast methodology and assumptions. Final report, July 1985, 14:36267 (R;US)
GRI (Gas Research Institute) 1984 baseline projection forecast summary. Final report, 14:36266 (R;US)

GRI (Gas Research Institute) baseline projection summary. Final report, 14:36262 (R;US)

ENERGY DENSITY
Density functional theory and f electron systems, 14:37693 (BA;US)

ENERGY EFFICIENCY
Performance monitoring protocols, 14:36393 (R;US)
[Discussions with International Energy Agency's Center for the Analysis and Dissemination of Demonstrated Energy Technologies concerned with database and analysis study series of reports, Sittard, Netherlands, May 22–26, 1989]: Foreign trip report, 14:37821 (R;US)

ENERGY EXPENSES
GRI (Gas Research Institute) 1983 baseline projection forecast summary. Final report, 14:36263 (R;US)
GRI (Gas Research Institute) 1984 baseline projection forecast summary. Final report, 14:36266 (R;US)

ENERGY FACILITIES
Effective implementation of safeguards and security requirements, 14:37790 (R;US)
Planning for large-scale construction projects. A socio-economic guide for communities, industry, and government, 14:37282 (R;CA)

ENERGY MANAGEMENT
Budgetary incentives for municipal energy management, 14:36425 (R;US)
Business guide to energy performance contracting. Final report, 14:36392 (R;US)

ENERGY MODELS
GRI (Gas Research Institute) 1983 baseline project forecast methodology and assumptions. Final report, November 1983, 14:36264 (R;US)
GRI (Gas Research Institute) 1984 baseline project forecast methodology and assumptions. Final report, July 1985, 14:36267 (R;US)

ENERGY SECURITY ACT
Cool Water Coal Gasification Program: Monitoring Review Committee meeting report, Washington, D.C., July 12, 1988, 14:35540 (R;US)

ENERGY SOURCE DEVELOPMENT
Alberta/Canada Energy Resources Research Fund annual review, 1987-1988, 14:36238 (R;CA;In English and French)
Cost effectiveness, 14:35656 (R;NO)

ENERGY SOURCES
See also FOSSIL FUELS
NUCLEAR FUELS
RENEWABLE ENERGY SOURCES
Energy technology R and D: What could make a difference?: A study by the staff of the Oak Ridge National Laboratory: Part 1, Synthesis report: Volume 1, 14:36245 (R;US)
Innovative financing plans for privately owned waste-to-energy facilities: Volume 2, User's guide, 14:36430 (R;US)

ENERGY SUPPLIES
DRI (Data Resources Inc.) Energy Model/GRI (Gas Research Institute) Hydrocarbon Model and IFCAM linkage. Final report, September 1983, 14:36265 (R;US)
DRI (Data Resources Inc.) Energy Model/GRI (Gas Research Institute) Hydrocarbon Model and IFCAM linkage. Final report, December 1984, 14:36268 (R;US)
GRI (Gas Research Institute) 1983 baseline project forecast methodology and assumptions. Final report, November 1983, 14:36264 (R;US)
GRI (Gas Research Institute) 1983 baseline projection forecast summary. Final report, 14:36263 (R;US)
GRI (Gas Research Institute) 1984 baseline project forecast methodology and assumptions. Final report, July 1985, 14:36267 (R;US)
GRI (Gas Research Institute) 1984 baseline projection forecast summary. Final report, 14:36266 (R;US)
GRI (Gas Research Institute) baseline projection summary. Final report, 14:36262 (R;US)
Petroleum supply monthly, April 1989: Final 1988 statistics in summary section, 14:35650 (R;US)
Petroleum supply monthly, March 1989, 14:35649 (R;US)

ENERGY SYSTEMS
See also HEATING SYSTEMS
HOT-DRY-ROCK SYSTEMS
LIGHTING SYSTEMS
NATURAL GAS DISTRIBUTION SYSTEMS
Energy technology R and D: What could make a difference?: A study by the staff of the Oak Ridge National Laboratory: Part 1, Synthesis report: Volume 1, 14:36245 (R;US)
ORMONTE: An uncertainty analysis code for use with user-developed systems models on mainframe or personal computers: A user's guide, 14:37808 (R;US)

ENERGY-LEVEL TRANSITIONS
Selective population of the highest spin n-p states in heavy nuclei via the (α, d) reaction at 218 MeV, 14:37588 (R;FR)

ENGINEERED SAFETY SYSTEMS
See also AIR CLEANING SYSTEMS
CONTAINMENT SYSTEMS
Role of environmental qualification training in nuclear plant maintenance, 14:36140 (RA;US)

ENGLAND
See UNITED KINGDOM

ENHANCED RECOVERY
See also THERMAL RECOVERY
Hydrogeological and geochemical criteria for assessing sites of subsurface injection of EOR waste water in the Cold Lake area, Alberta, Canada, 14:35739 (RA;CA)

ENTRY CONTROL SYSTEMS
Design of an advanced entry control system, 14:36886 (R;US)

ENVIRONMENT
Automatic programmable air sampling stations. Instruction manual, 14:37118 (R;AT;In German)

ENVIRONMENTAL EXPOSURE PATHWAY
Canadian contributions to the safety and environmental aspects of fusion, 14:37757 (R;CA)
Residual radioactive material guidelines: Methodology and applications, 14:35823 (R;US)

ENVIRONMENTAL POLICY
Environmental Regulatory Update Table, May 1989, 14:37220 (R;US)
Lawrence Livermore National Laboratories Environmental Protection Department 1988 California legislative highlights, 14:36233 (R;US)

ENVIRONMENTAL PROTECTION AGENCY
See US EPA

EPA
See US EPA

EPIDERMIS
Radiation exposure to skin following radioactive contamination, 14:37384 (R;DD;In German)

EPIPHYSIS (BONES)
See BONE TISSUES

EPSILON RESONANCES
See MESONS

EPSTEIN-BARR VIRUS
See ONCOGENIC VIRUSES

EQUATIONS (DIFFERENTIAL)
See DIFFERENTIAL EQUATIONS

ERBIUM OXIDES
Characterization of YBaCuO and ErBaCuO thin films deposited on silicon and gallium arsenide substrates, 14:36899 (J;US)

EROSION
Contribution of dynamics and erosion for small tube arrays in fluidized beds, 14:35580 (R;US)

ERUPTIVE VARIABLE STARS
See also NOVAE
SUPERNOVAE
Observations and simulations of Nova Vul 1984 2: a Nova with ejecta rich in oxygen, neon, and magnesium, 14:37437 (RA;FR)
Simultaneous IUE, exosat, and optical observations of the unusual AM Her type variable H0538+608, 14:37433 (RA;FR)

ESCHERICHIA COLI
Role of the bacterial host in the mechanism and regulation of Tn10 transposition, 14:37304 (RA;US)

SOS mutagenesis and replisome reactivation in bacteria: options acquired by transposition?, 14:37340 (RA;US)

ESTUARIES
See also LONG ISLAND SOUND
Prediction of post barrage densities of shorebirds. V. 1. Overview, 14:35947 (R;GB)
Prediction of post barrage densities of shorebirds. V. 3. Invertebrates, 14:35946 (R;GB)
Prediction of post barrage densities of shorebirds. V. 4. Birds, 14:35945 (R;GB)

ESTUARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS

ETA MESONS
Physics with ETA mesons, 14:37510 (R;US)

ETA-549
See ETA MESONS

ETA-700 RESONANCES
See MESONS

ETHANAL
See ACETALDEHYDE

ETHANOL
Separation of low molecular weight alcohols from dilute aqueous solutions by reversible chemical complexation, 14:36725 (R;US)

ETHANOL FUELS
Cost goals for biofuels technologies, 14:35864 (BA;US)
Performance and durability evaluation of a Moteurgaro engine fueled with ethanol, 14:36450 (R;ZA)
Recycling of cellulose enzyme complex after cellulose hydrolysis. Final report, 14:35863 (R;US)

ETHOCEL
See CELLULOSE

ETHYL ALCOHOL
See ETHANOL

ETHYLALDEHYDE
See ACETALDEHYDE

ETHYLENE
Study of data distributions and functions for the development of thermodynamic equations of state. Annual report, June 1987-May 1988, 14:35686 (R;US)

ETHYLENE POLYMERS
See POLYETHYLENES

EUCLIDEAN SPACE
Local structure of a 2-codimensional conformally flat submanifold in an Euclidean space R^{n+2}, 14:37699 (R;XA)

EUROPE
Cogeneration in Europe, 14:36250 (RA;US)
Offensive versus defensive tradeoffs in the European theater, 14:36456 (R;US)

EUROPIUM COMPLEXES
Determination of thermodynamic characteristics of extraction equilibria in the systems containing ammonium salts and organic phosphorus compounds (Solvent extraction of nitrates of Ce, Pr, Eu, UO_2^{2+}, Th.), 14:36717 (RA;SU)
Effect of cesium ions on character of solubility and rare earth formate complexing processes, 14:36778 (RA;SU;In Russian)
Equilibrium on metal extraction with substituted ammonium salts effect of non-ideality of the organic phase, 14:36361 (RA;SU)

EUROPIUM COMPOUNDS
Effect of cesium ions on character of solubility and rare earth formate complexing processes, 14:36778 (RA;SU;In Russian)

EVACUATED COLLECTORS
Development of a carbonaceous selective absorber for solar thermal energy collection and process for its formation: Final report, 14:35929 (R;US)

EVENT TREE ANALYSIS
See FAILURE MODE ANALYSIS

EXCAVATORS
See EARTHMOVING EQUIPMENT

EXCHANGE (CHARGE)
See CHARGE EXCHANGE

EXCHANGE (HEAT)
See HEAT TRANSFER

EXCIMER LASERS
See also KRYPTON FLUORIDE LASERS
Studies of collisional and nonlinear radiative processes for development of coherent uv and xuv sources. Final report, 30 September 1985-29 September 1988, 14:37463 (R;US)

EXCITED STATES
See also RYDBERG STATES
Selective population of the highest spin n-p states in heavy nuclei via the (α, d) reaction at 218 MeV, 14:37588 (R;FR)

EXCITON MODEL
On the two gas approach for exciton model master equation, 14:37611 (RA;XA)

EXPERIMENTAL FACILITIES (ACCELERATOR)
See ACCELERATOR FACILITIES

EXPERIMENTAL REACTORS
See also HTTR REACTOR
Magnet systems for the international thermonuclear experimental reactor, 14:36909 (J;US)

EXPLOSIONS
See also NUCLEAR EXPLOSIONS
An architecture for real-time control and data acquisition at LLNL's high explosives application facility (HEAF), 14:37153 (R;US)

EXPLOSIVES
Explosives detection with an ion trap mass spectrometer, 14:37148 (R;US)
Hazards of explosives dusts, 14:37150 (R;US)
Techniques for the detection of explosives, 14:37149 (R;US)

EXPOSURE (RADIATION DOSES)
See RADIATION DOSES

EXTRACTION (SOLVENT)
See SOLVENT EXTRACTION

EXTRACTION COLUMNS
Recent advances in centrifugal contactor design, 14:35822 (J;US)

EXTREME ULTRAVIOLET RADIATION
Studies of collisional and nonlinear radiative processes for development of coherent uv and xuv sources. Final report, 30 September 1985-29 September 1988, 14:37463 (R;US)
XUV laser amplification in recombining laser-produced plasmas, 14:37489 (D;GB)

F

F STATES
Density functional theory and f electron systems, 14:37693 (BA;US)

F-1540 RESONANCES
See MESONS

FACILITIES (ACCELERATOR)
See ACCELERATOR FACILITIES

FACILITIES (EDUCATIONAL)
See EDUCATIONAL FACILITIES

FACILITIES (ENERGY)
See ENERGY FACILITIES

FACILITIES (MAINTENANCE)
See MAINTENANCE FACILITIES

FACILITIES (MILITARY)
See MILITARY FACILITIES

FACILITIES (NUCLEAR)
See NUCLEAR FACILITIES

FAILED ELEMENT MONITORS
Failed element monitor for a NPP, 14:36104 (RA;SU;In Russian)

FAILURE MODE ANALYSIS
Micro-computer fault tree program as a tool for defining problems, 14:35976 (RA;XA)

FALLOUT
Experimental data on weakening gamma-radiation by boring well, 14:37648 (RA;SU;In Russian)

FALLOUT PARTICULATES
See FALLOUT

FARADAY GENERATORS
See MHD GENERATORS

FAST BREEDER TYPE REACTORS
See FBR TYPE REACTORS

FAST FISSION
Fusion-fission of heavy systems: influence of the entrance channel mass asymmetry, 14:37578 (R;FR)
FAST FLUX TEST FACILITY REACTOR
See FFTF REACTOR
FAST NEUTRONS
DNA exchange in mice spleen at early periods following fast neutron irradiation with different energy rate, 14:37378 (RA;SU;In Russian)
FAST-MIXED SPECTRUM REACTOR
See FBR TYPE REACTORS
FASTENERS
Compilation of fastener testing data received in response to NRC Compliance Bulletin 87-02, 14:36051 (R;US)
TMI-2 leadscrew radionuclide deposition and characterization, 14:36192 (BA;US)
FATIGUE (BIOLOGICAL)
See BIOLOGICAL FATIGUE
FATTY ACIDS
See CARBOXYLIC ACIDS
FAULT TREE ANALYSIS
CYRO - A fault tree analysis code for personal computers, 14:35981 (RA;XA)
RELTREE - A PC program for fault tree construction, documentation and analysis, 14:35982 (RA;XA)
FAULT TREE SYSTEMS
See FAULT TREE ANALYSIS
FBR TYPE REACTORS
See also LMFBR TYPE REACTORS
GABI program abstract, 14:36030 (RA;SU;In Russian)
PRECON program abstract, 14:36031 (RA;SU;In Russian)
FEDERAL REGION V
Biomass energy facilities: 1988 Directory of the Great Lakes region, 14:35902 (R;US)
FEDERAL REPUBLIC OF GERMANY
Non-proliferation regime, vertical proliferation and the interests of the Federal Republic of Germany, 14:36247 (R;DE;In German)
FEED MATERIALS PRODUCTION CENTER
Implementing requirements for radiation worker training from DOE Order 5480.11, 14:35754 (R;US)
FEMALES
Dependence of reproduction indices of female mice on their age under the effect of fractionated irradiation, 14:37358 (RA;SU;In Russian)
FERMENTATION ALCOHOL
See ETHANOL
FERMI-THOMAS MODEL
See THOMAS-FERMI MODEL
FERMILAB ACCELERATOR
QA at Fermilab, 14:37029 (J;US)
FERMILAB TEVATRON
Flux creep in a Tevatron cable, 14:36932 (J;US)
Studies of time dependence of fields in Tevatron superconducting dipole magnets, 14:36921 (J;US)
Time variations of fields in superconducting magnets and their effects on accelerators, 14:36920 (J;US)
FERRITE
Metallurgical aspects of crack-tip failure processes, 14:36590 (BA;US)
FERRITIN
On the effect of iron on plutonium metabolic mechanism in liver tissue, 14:37363 (RA;SU;In Russian)
FERROCENE
Cognition and order in Langmuir-Blodgett films of a 3-hexadecyl pyrrole and ferrocene-derivatized pyrrole mixed monolayer system, 14:36659 (R;US)
FFTF REACTOR
Evaluation of the advanced mixed oxide fuel test FO-2 irradiated in Fast Flux Test Facility, 14:36037 (R;US)
FFTF metal fuel pin sodium bond quality verification, 14:36036 (R;US)
Fast Flux Test Facility passive safety reactivity feedback measurements, 14:36034 (R;US)
Thermo-plastic analysis of a bowed sodium pump shaft, 14:36035 (R;US)
FIBROBLASTS
Induction of VL30 element expression as a response to anoxic stress, 14:37388 (RA;US)
FIELD PRODUCTION EQUIPMENT
Optimizing heavy oil production through innovative techniques. Proceedings [of the] fourth quarterly meeting of the Canadian Heavy Oil Association, 14:35618 (R;CA)
FIELDS (ELECTRIC)
See ELECTRIC FIELDS
FIELDS (ELECTROMAGNETIC)
See ELECTROMAGNETIC FIELDS
FIELDS (GRAVITATIONAL)
See GRAVITATIONAL FIELDS
FIELDS (MAGNETIC)
See MAGNETIC FIELDS
FILTERS
Characterization of fiber-reinforced particulate filters, 14:35961 (R;US)
FINGERPRINTING (OIL SPILLS)
See OIL SPILLS
FIRE FLOODING
See IN-SITU COMBUSTION
FIREDAMP
See METHANE
FIRST WALL
Plugging regime in the pump limiter throat, 14:37719 (R;FR)
Tore Supra first wall description and behaviour during the initial plasma experiments, 14:37760 (R;FR)
FISCHER-TROPSCH SYNTHESIS
Assessment of the techno-economic potential of Fischer-Tropsch slurry reactors, 14:35543 (R;ZA)
Changes in pore structure of precipitated iron oxide catalysts during pretreatment and hydrocarbon synthesis reaction, 14:36733 (RA;CA)
FISH CULTURE
See FISHERIES
FISH HATCHERIES
See FISHERIES
FISH LADDERS
See FISH PASSAGE FACILITIES
FISH LIFTS
See FISH PASSAGE FACILITIES
FISH LOCKS
See FISH PASSAGE FACILITIES
FISH PASSAGE FACILITIES
Assessing the opportunity cost of fish mitigation activities in the Columbia River Basin, 14:35888 (RA;US)
Data needs for proposed pilot study, 14:35889 (RA;US)
Feasibility of implementing the least-cost model, 14:35887 (RA;US)
Identifying the most cost-effective fish mitigation strategy: the least-cost model, 14:35886 (RA;US)
Modeling downstream migration, 14:35879 (RA;US)
Modeling the upstream migration of adult salmonids, 14:35882 (RA;US)
FISHERIES
Assessing the cost-effectiveness of alternative mitigation strategies: the simulation model, 14:35885 (RA;US)
Data needs for proposed pilot study, 14:35889 (RA;US)
Determination of economic impacts, 14:35893 (RA;US)
Economic analyses of fish mitigation strategies, 14:35884 (RA;US)
Evaluation of the impact of acid deposition on Eastern Canada's sport fishery, 14:37390 (RA;CA)
History of the Columbia River salmon fisheries, 14:35890 (RA;US)
Juvenile production, 14:35878 (RA;US)
Mathematical programming models of the ocean salmon fishery, 14:35891 (RA;US)
Modeling the estuary and early ocean life stanza, 14:35880 (RA;US)
Modeling the late ocean life stanza, 14:35881 (RA;US)
Overview of models, 14:35877 (RA;US)

Procedures for valuing changes in ocean salmon stocks, 14:35892 (RA;US)
Report on Working Group deliberations: Water quality group, 14:37215 (R;US)
Results of fisheries investigations in Douglas tailwater, August 1987–September 1988, 14:35897 (R;US)
Smolt monitoring in the Columbia River Basin, 14:35883 (RA;US)
Systems analysis and the fish and wildlife program, 14:35876 (RA;US)

FISHES
See also ANADROMOUS FISHES
TROUT
Distribution, abundance, and transport of larval sciaenids collected during winter and early spring from the continental shelf waters off west Louisiana, 14:37254 (J;US)
Evaluation of the impact of acid deposition on Eastern Canada's sport fishery, 14:37390 (RA;CA)
Preliminary assessment of the current impact and potential risk of acidic deposition on walleye populations in Ontario, 14:37392 (R;CA)

FISHWAYS
See FISH PASSAGE FACILITIES

FISSION
See also FAST FISSION
Discovery and confirmation of fission, 14:37602 (R;DE)
Fifty years of nuclear fission: Nuclear data and measurements series, 14:37560 (R;US)
Technique for fission measurements of highly active and weak cross-section actinides, 14:37605 (R;US)

FISSION BARRIER
Fission barriers for r-process nuclei and implications for astrophysics, 14:37636 (R;US)

FISSION NEUTRONS
DNA exchange in mice spleen at early periods following fast neutron irradiation with different energy rate, 14:37378 (RA;SU;In Russian)
Mass-split dependence of the pre- and post-scission neutron multiplicities for fission of ^{251}Es, 14:37607 (R;AU)
Measurement and statistical model analysis of pre-fission neutron multiplicities, 14:37606 (R;AU)

FISSION PRODUCT RELEASE
Correlation of recent fission product release data, 14:36110 (R;US)
Fission products plate-out analysis code in the HTGR: PLAIN, 14:36021 (R;JP;In Japanese)

FISSION PRODUCTS
A sensitivity of aerosol agglomeration and deposition using the MAEROS model, 14:36188 (BA;US)
Characterization and chemistry of fission products released from LWR fuel under accident conditions, 14:36184 (BA;US)
Iodine volatility, 14:36186 (BA;US)
LWR aerosol containment experiments (LACE) program and initial test results, 14:36187 (BA;US)
Mass spectrometric study of the release of volatile fission products from irradiated LWR fuel, 14:36185 (BA;US)
Radionuclide distribution in TMI-2 reactor building basement liquids and solids, 14:36193 (BA;US)
Results of surface activity and radiation field measurements made during surface decontamination experiments conducted at TMI-2, 14:36194 (BA;US)
TMI-2 core debris analytical methods and results, 14:36191 (BA;US)
TMI-2 leadscrew radionuclide deposition and characterization, 14:36192 (BA;US)

FISSIONABLE MATERIALS MANAGEMENT
See NUCLEAR MATERIALS MANAGEMENT

FISSURED FORMATIONS
See FRACTURED RESERVOIRS

FLAMES
Enhanced flame stability and soot radiation using electric fields. Annual report, July 1987-July 1988, 14:35687 (R;US)
Suppression of soot in flames by alkaline-earth and other metal additives, 14:36866 (R;US)

FLAVOR MODEL
B->$X_s e^+ e^-$ in the six-quark model, 14:37538 (J;NL)
Enhanced CP violations in hadronic charm decays, 14:37542 (J;NL)

FLOODS
High temperature flood injury of woody swamp seedlings, 14:35916 (J;US)

FLOW (FLUID)
See FLUID FLOW

FLOWMETERS
Effect of diffusion on flow-rate time-of-flight measurements, 14:37136 (RA;SU;In Russian)

FLUE GAS
Clean Coal Technology Demonstration Program: Draft Programmatic Environmental Impact Statement, 14:35565 (R;US)
High-sulfur spray dryer Shawnee test program: Characterization of 10-MW spray-dryer electrostatic precipitator by-product: Final report, 14:35963 (R;US)

FLUID FLOW
See also INCOMPRESSIBLE FLOW
LAMINAR FLOW
MULTIPHASE FLOW
SOLIDS FLOW
TURBULENT FLOW
TWO-PHASE FLOW
A central difference type approximation of convection in fluid flow, 14:36977 (R;US)
A discrete fracture model for a hot dry rock geothermal reservoir, 14:35941 (R;US)
Long-term degradation of dilute polyacrylamide solutions in turbulent pipe flow, 14:36422 (R;US)

FLUID MECHANICS
See also HYDRODYNAMICS
CFD (computational fluid dynamics) research for minisupercomputers: a Yale/UTRC program. Final report, 15 February 1987-14 October 1988, 14:37478 (R;US)
Computational fluid dynamics (CFD): element-by-element analysis for advanced computers. Final report, 1 April 1987-14 November 1988, 14:37479 (R;US)

FLUIDIZED BED
See FLUIDIZED BEDS

FLUIDIZED BED BOILERS
Tube wastage in FBC boilers at Summerside - causes and resolution, 14:37022 (R;CA)
Tube wastage in FBC boilers at Summerside - causes and resolution, 14:35587 (R;CA)

FLUIDIZED BED HEAT EXCHANGERS
Tube wastage in FBC boilers at Summerside - causes and resolution, 14:37022 (R;CA)

FLUIDIZED BEDS
Electrically stabilized expanded beds for sorption separations, 14:36706 (R;US)
The selective oxidation desulfurization process: bench-scale studies: Final report, 14:35532 (R;US)

FLUIDIZED-BED COMBUSTION
Clean Coal Technology Demonstration Program: Draft Programmatic Environmental Impact Statement, 14:35565 (R;US)
Modelling of sulphur dioxide capture in fluidized bed combustion, 14:35593 (R;SE)
Modelling of sulphur dioxide capture in fluidized bed combustion, 14:35594 (R;SE)
Modelling of sulphur dioxide capture in fluidized bed combustion, 14:35593 (R;SE)

FLUIDIZED-BED COMBUSTORS
Contribution of dynamics and erosion for small tube arrays in fluidized beds, 14:35580 (R;US)

FLUORINATED ALIPHATIC HYDROCARBONS
The equation of state of perfluorododecane to 48 GPa, 14:36847 (R;US)

FLUORINE 19 BEAMS
Shape coexistence at high spin in ^{187}Au, 14:37593 (R;FR)

FLUOROD
See RPL DOSEMETERS

FLY ASH
Fly ash/cement packing for Lingan Mine: final appraisal and trial proposal, 14:35561 (R;CA)
Leaching characteristics of incinerator residues and potential for modification of leaching, 14:36431 (R;NL)
Secondary atomization of coal-water fuels for gas turbine applications: Final report, 14:35581 (R;US)
Structural-engineering studies on the use of filter dusts from waste-incinerator flue gas cleaning as an aggregate bitumen in road construction, 14:36420 (R;DE;In German)
Trace metal removal by iron coprecipitation: Field evaluation: Final report, 14:35960 (R;US)

FOG (SPRAYS)
See SPRAYS

FOILS
An improved hibachi support structure for electron-beam diode foils, 14:36963 (R;US)
Exploding metallic foils and fuses: A computational modeling update, 14:37006 (R;US)
Foil implosion studies on PEGASUS, 14:37686 (R;US)
Plasma flow switch characterization for the Los Alamos Foil Implosion Project, 14:37012 (R;US)
The Mark IX generator, 14:37004 (R;US)

FOLIAGE
See LEAVES

FOOD
See also VEGETABLES
[Radiological incidents, Tours, France, June 18–June 24, 1988]: Foreign trip report, 14:37334 (R;US)

FOOD INDUSTRY
Combustion research opportunities for industrial applications: Phase II, 14:36412 (R;US)

FOODSTUFFS
See FOOD

FORESTS
Canopy photography for assessment of local light environment of tropical forest trees and palms, 14:35918 (J;US)
Evaluating spatial patterns of forest productivity in a disturbed, mountainous landscape using LANDSAT data and a GIS, 14:37338 (J;US)
Event studies and the interpretation of water quality in forested basin, 14:37245 (RA;NO)
GIS and remote sensing as tools for detection of landscape pattern and processes, 14:35923 (J;US)
Hydrologic system characterisation for biogeochemical process research in forest ecosystems, 14:37236 (RA;NO)
Investigation about the usefulness of Landsat 5 thematic mapper data for mapping forest disease, 14:37160 (R;DE;In German)
Long-term recovery of northern hardwood forest following gamma irradiation, 14:37337 (J;US)
Net throughfall chemistry and atmospheric deposition at two forests of different elevations, 14:35924 (J;US)
Oxygen isotopic composition of sulphates in the uplandforest of the plastic lake watershed, 14:37237 (RA;NO)
Precipitaton, surface and subsurface water chemistry in a tolerant hardwood forest basin, 14:37262 (RA;NO)
Regeneration patterns in a southeastern floodplain forest, 14:37213 (J;US)
Toxicology of ozone. April 1988-April 1989 (Citations from the NTIS data base). Report for April 1988-April 1989, 14:37394 (R;US)
Toxicology of ozone. January 1970-March 1988 (Citations from the NTIS data base). Report for January 1970-March 1988, 14:37393 (R;US)

FORMALDEHYDE
Mutation induction by MR(P) and its modification by various conditions, 14:37341 (RA;US)
Studies as to the measurement and the chemistry of formaldehyde and acetaldehyde in the lower troposphere, 14:37171 (R;DE;In German)
[Dynamics of vibrationally excited polyatomic molecules and their unstable isomers on the electronic ground state potential surface]: Progress report, 14:36740 (R;US)

FORMALIN
See FORMALDEHYDE

FORMALITH
See FORMALDEHYDE

FORMIC ALDEHYDE
See FORMALDEHYDE

FORMOL
See FORMALDEHYDE

FOSSIL FUEL RESERVES
See FOSSIL FUELS

FOSSIL FUELS
See also COAL
NATURAL GAS
OIL SANDS
OIL SHALES
PEAT
PETROLEUM
Cost goals for biofuels technologies, 14:35864 (BA;US)
Estimates of CO_2 emissions from fossil fuel burning and cement manufacturing, based on the United Nations energy statistics and the US Bureau of Mines cement manufacturing data, 14:37173 (R;US)

FOSSIL-FUEL POWER PLANTS
Clean Coal Technology Demonstration Program: Draft Programmatic Environmental Impact Statement, 14:35565 (R;US)
Cost impact of potential RCRA (Resource Conservation Recovery Act) changes on New York State Utility coal-waste disposal. Final report, 14:35563 (R;US)
Design guidelines for a furnace sorbent injection waste management system: Final report, 14:35959 (R;US)
Development of dredged ash disposal area: Johnsonville Fossil Plant: Final environmental assessment, 14:35564 (R;US)
High-sulfur spray dryer Shawnee test program: Characterization of 10-MW spray-dryer electrostatic precipitator by-product: Final report, 14:35963 (R;US)
Hybrid power system studied, 14:35956 (J;US)
Utilization potential of coal-combustion by-products: Somerset Power Plant case study. Final report, 14:36418 (R;US)
Waste heat recovery in remote communities. A shared opportunity, 14:35953 (R;CA)

FOURIER TRANSFORM SPECTROMETERS
The Los Alamos Fourier-transform spectrometer: Applications to molecular spectroscopy, 14:37138 (R;US)

FRACTALS
Scattering from fractals, 14:37690 (R;US)

FRACTURE MECHANICS
Damage predictions for wind turbine components using the LIFE2 computer code, 14:36881 (R;US)
Recent advances in modelling creep crack growth. Proceedings, 14:36545 (R;DE)

FRACTURED FORMATIONS
See FRACTURED RESERVOIRS

FRACTURED RESERVOIRS
Reservoir Engineering and Treatment Design Technology. Annual report, December 1987-November 1988, 14:35676 (R;US)

FRAGMENTS (FALLOUT)
See FALLOUT

FRANK LOOPS
See SCREW DISLOCATIONS

FREE ELECTRON LASERS
Free electron laser with small period wiggler and sheet electron beam: A study of the feasibility of operation at 300 GHz with 1 MW CW output power, 14:36961 (R;US)
High-power, high-efficiency FELs, 14:36965 (R;US)
Prospects for the FEL [Free Electron Laser], 14:36964 (R;US)
Tapering FEL amplifiers in wiggler period and field, 14:36966 (R;US)

FREE RADICALS
See RADICALS

FRESH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS

FRICTION
Long-term degradation of dilute polyacrylamide solutions in turbulent pipe flow, 14:36422 (R;US)

FROGS
Radiation and feeding effects on O_2 uptake in frog tadpoles, 14:37354 (RA;AU)
FTR REACTOR (RICHLAND)
See FFTF REACTOR
FUEL ADDITIVES
Suppression of soot in flames by alkaline-earth and other metal additives, 14:36866 (R;US)
FUEL CANS
ELL program abstract, 14:36092 (RA;SU;In Russian)
FUEL CELL POWER PLANTS
On-site municipal fuel cell power plant: Feasibility and applications guide, 14:36361 (R;US)
FUEL CELLS
See also ACID ELECTROLYTE FUEL CELLS
HYDROCARBON FUEL CELLS
NATURAL GAS FUEL CELLS
Clean Coal Technology Demonstration Program: Draft Programmatic Environmental Impact Statement, 14:35565 (R;US)
Electrode materials and processes for energy conversion and storage, 14:36223 (B;US)
Fuel cell technology in the United States, 14:36362 (R;US)
Solid-oxide fuel-cell technology development. Annual report, May 1, 1987-April 30, 1988, 14:36365 (R;US)
The influence of surface capacitance on the measurements of localized corrosion transients, 14:36368 (BA;US)
FUEL CHANNELS
Comparison of mathematical models of non-equilibrium boiling for calculation of non-stationary processes, 14:36980 (RA;SU;In Russian)
FUEL COOLING INSTALLATIONS
See SPENT FUEL STORAGE
FUEL CYCLE
ASTM C-26 committee and standards development, 14:35745 (R;US)
FUEL ELEMENTS
See also FUEL PINS
FUEL RODS
Correlation of recent fission product release data, 14:36110 (R;US)
FUEL FABRICATION PLANTS
Relating quality at work to quality at home, 14:35755 (RA;US)
FUEL INJECTION SYSTEMS
Laboratory evaluation of MIL-T-83133 JP-8 fuel in army diesel engines. Interim report, October 1984-January 1988, 14:35666 (R;US)
FUEL OILS
Conversion of methanol over zeolite ZSM-5, 14:35859 (R;ZA)
Creating fuel oil from sewage sludge, 14:35857 (R;CA;In English and French)
FUEL PENCILS
See FUEL PINS
FUEL PINS
Fast Flux Test Facility metal fuel pin fabrication, 14:35759 (R;US)
FUEL POOLS
Fresh fuel verification feasibility study, 14:36989 (R;CA)
FUEL REPROCESSING PLANTS
[Analytical chemistry in nuclear technology, Karlsruhe, Germany and visit to Seibersdorf, Austria, June 3–22, 1989]: Foreign trip report, 14:35766 (R;US)
FUEL ROD CONSOLIDATION
See FUEL RODS
FUEL RODS
Base irradiation history and interim inspection of the BWR test fuel rods of rod group BK7: The Studsvik Super-Ramp Project, 14:35997 (R;SE)
Base irradiation history and interim inspection of the KWU/CE test fuel rods of rod groups PK 1 and PK 2: The Studsvik Super-Ramp Project, 14:36013 (R;SE)
Fabrication, pre-irradiation characterization and irradiation history of GE rods, for The Super-Ramp Project: The Studsvik Super-Ramp Project, 14:35998 (R;SE)
Non-destructive examinations of PW 5 rods: The Studsvik Super-Ramp Project, 14:36093 (R;SE)
Rod overpressure experiment (ROPE). Pre-project, 14:35995 (R;SE)
Test fuel rod fabrication and pre-irradiation characterization report, rod groups PK1, PK2 and BK7: Studsvik Super-Ramp Project, 14:35996 (R;SE)
The Studsvik Super-Ramp Project: Quarterly progress report, April–June, 1982, 14:35999 (R;SE)
The Studsvik Super-Ramp Project: Quarterly progress report, July–September, 1982, 14:36000 (R;SE)
FUEL SHEATHS
See FUEL CANS
FUEL SLUGS
See FUEL RODS
FUEL SLURRIES
Assessment of the techno-economic potential of Fischer-Tropsch slurry reactors, 14:35543 (R;ZA)
Correlation of stability/rheology relationship with coal properties and chemical additives: Quarterly progress report, September 15, 1988–December 15, 1988, 14:35554 (R;US)
Development of a pulsed coal combustor fired with CWM [coal-water mixture]: Phase 3, Final report, 14:35582 (R;US)
Measurements of solids concentrations in coal slurries using microwaves, 14:35550 (R;CA)
Secondary atomization of coal-water fuels for gas turbine applications: Final report, 14:35581 (R;US)
FUEL SUBSTITUTION
Feasibility of industrial coal conversion at Cornell University. Final report, 14:35542 (R;US)
FUEL SUSPENSIONS
See FUEL SLURRIES
FUELS
See also AUTOMOTIVE FUELS
FOSSIL FUELS
FUEL SLURRIES
JET ENGINE FUELS
LIQUID FUELS
NUCLEAR FUELS
REFUSE DERIVED FUELS
SYNTHETIC FUELS
CANMET review 1986-1987, 14:36239 (R;CA;In English and French)
FUELS (NUCLEAR)
See NUCLEAR FUELS
FUMES
See AEROSOLS
FUNGI
Microbial coal liquefaction, 14:35520 (R;US)
FUSION (NUCLEAR)
See THERMONUCLEAR REACTIONS
FUSION (WELDING)
See WELDING
FUSION ENERGY
See THERMONUCLEAR REACTORS
FUSION REACTORS
See THERMONUCLEAR REACTORS

G

G CODES
Program listings for GRPANL: A suite of computer programs for analyzing complex Ge and alpha-particle detector spectra: Volume 3, 14:37120 (R;US)
User's manual: GCOST: A gas cost-of-service program: Version 1.0, 14:36432 (R;US)
GADOLINIUM
Nd:Cr:GSGG, will it replace Nd:YAG, 14:36971 (BA;US)
GADOLINIUM BORIDES
Fundamental magnetic studies of iron-rare-earth-metalloid alloys: Technical performance report, 14:36483 (R;US)
GADOLINIUM OXIDES
Investigation of the lanthanide sesquioxides as high temperature transformation toughening agents, 14:36648 (B;US)

GAGES (STRAIN)
See STRAIN GAGES
GALLIUM
Critical phenomenon and segregation behavior at interfaces and subgrain boundaries, 14:36540 (BA;FR)
Nd:Cr:GSGG, will it replace Nd:YAG, 14:36971 (BA;US)
Novel approaches to ionic chromatography: Progress report, December 1, 1987–June 30, 1989, 14:36707 (R;US)
GALLIUM 71 TARGET
Measurement of solar proton-proton fusion neutrinos with a Soviet-American gallium experiment: Technical progress report, 14:37583 (R;US)
GALLIUM ARSENIDES
Absolute pressure derivatives of deep level defects in III-V semiconductors, 14:36697 (BA;US)
Characterization by positron annihilation of vacancies in gallium arsenide, 14:36675 (R;FR;In French)
Critical phenomenon and segregation behavior at interfaces and subgrain boundaries, 14:36540 (BA;FR)
Grain boundaries and antiphase boundaries in GaAs, 14:36670 (BA;FR)
High resolution electron microscopy of interfaces in functional materials, 14:36623 (BA;FR)
Lattice relaxation of the DX centers in $Ga_{1-x}Al_xAs$ and of the pressure-induced deep donors in GaAs, 14:36699 (BA;US)
Pressure-dependent DLTS experiments on Si-doped AlGaAs, 14:36700 (BA;US)
Vertical gradient freeze GaAs: Growth and electrical properties, 14:36576 (R;US)
GALLIUM COMPOUNDS
See also GALLIUM ARSENIDES
Study of physicochemical properties of alkali metal salts of 12-tungstogallic acid, 14:36768 (RA;SU;In Russian)
GAMMA DOSIMETRY
High-dose intercomparison study involving red 4034 perspex and radiochromic dye films, 14:37100 (R;GB)
GAMMA RADIATION
See also DELAYED GAMMA RADIATION
A study of the use of crosslinked high-density polyethylene for low-level radioactive waste containers, 14:35794 (R;US)
Environmental radioactivity levels Bellefonte Nuclear Plant: Annual report, 1988, 14:37232 (R;US)
GAMMA SOURCES
Recharging container, 14:36875 (RA;SU;In Russian)
GAMMA SPECTRA
Origin of the $^{13}C + {}^{17}O$ resonant structure, 14:37576 (R;FR)
GAMMA SPECTROMETERS
Particle transport simulation for spaceborne, NaI gamma-ray spectrometers, 14:37129 (R;GB)
GAMMA-RAY LASERS
See GASERS
GANIL
See GANIL CYCLOTRON
GANIL CYCLOTRON
Heavy ions beam axial injection tudy in a compact cyclotron, 14:37075 (R;FR;In French)
Heavy ions reactions below 100 MeV per nucleon: two contributions to the study of subthreshold pion production, 14:37601 (R;FR;In French)
Interaction of 20-100 MeV/u heavy ions with cold matter, 14:37573 (R;FR)
Production of 400 MeV/u radioactive ion beams for therapy purposes, 14:37574 (R;FR)
Theoretical and numerical study of cyclotron in space charge conditions, 14:37052 (R;FR;In French)
GARNETS
Nd:Cr:GSGG, will it replace Nd:YAG, 14:36971 (BA;US)
GAS CHROMATOGRAPHY
Evaluation of an on-line gas chromatographic system, 14:35545 (BA;US)
GAS COOLANTS
See GASES
GAS ENGINES
See INTERNAL COMBUSTION ENGINES
GAS FIELDS
See NATURAL GAS FIELDS
GAS FURNACES
A recuperative gas fired forge furnace, 14:37023 (R;US)
Compact ceramic heat exchangers. Final report, February 1983-June 1988, 14:35688 (R;US)
GAS HYDRATES
Study of cool storage using refrigerant gas hydrate, 14:36216 (RA;CA;In English and French)
GAS LASERS
See also EXCIMER LASERS
Optical pumping of vibrational overtones in KI:CN-infrared lasers, 14:36957 (R;US)
GAS TUNGSTEN-ARC WELDING
On the question of nonconsumable electrode measuring of temperature in the process of argon-arc welding, 14:36564 (RA;SU;In Russian)
GAS TURBINE ENGINES
Ceramic engine parts. January 1972-April 1989 (Citations from the International Aerospace Abstracts data base). Report for January 1972-April 1989, 14:36447 (R;US)
GAS TURBINE POWER PLANTS
A comparison of steam-injected gas turbine and combined-cycle power plants: Technology assessment: Final report, 14:35955 (R;US)
GAS TURBINES
See also COAL-FIRED GAS TURBINES
Clean Coal Technology Demonstration Program: Draft Programmatic Environmental Impact Statement, 14:35565 (R;US)
Heat exchanger development for steam-injected Brayton cycle: Final report for period September 30, 1984 to April 30, 1988, 14:36577 (R;US)
GAS UTILITIES
Application by Greater Winnipeg Gas Company and ICG Utilities (Manitoba) Ltd. for an order or orders approving rates for the sale of natural gas from November 1, 1988 to October 31, 1990, flowing from new gas supply contracts, 14:35677 (R;CA)
Energy privatisation, 14:36271 (R;GB)
Lessons from gas privatisation, 14:36273 (RA;GB)
User's manual: GCOST: A gas cost-of-service program: Version 1.0, 14:36432 (R;US)
GAS WELLS
See NATURAL GAS WELLS
GASERS
Gamma-ray-laser pump diagnostic. Final report, 14:37582 (R;US)
GASES
See also AIR
RARE GASES
HEGADAS: heavy gas dispersion program. User's guide, 14:37178 (R;GB)
Physiological aspects of deposition of trace gases to leaves, 14:37397 (J;US)
GASOLINE
Final report of the Commission of Inquiry into Gasoline Pricing in the province of Manitoba, 1987, 14:35655 (R;CA)
GASOLINE ENGINES
See INTERNAL COMBUSTION ENGINES
GENE LOCI
See GENES
GENE MUTATIONS
Concerted transposition in Drosophila melanogaster, 14:37307 (RA;US)
Molecular genetic studies of the mouse dilute locus: analysis of two dilute alleles and dilute-suppressor, 14:37306 (RA;US)
GENE RECOMBINATION
Genetic control of recombination between repeated sequences, 14:37293 (RA;US)
GENE REGULATION
Factors affecting retrotransposition of intracisternal A-particle proviral elements, 14:37289 (RA;US)
GENERAL RELATIVITY THEORY
See also RELATIVITY THEORY
Wormholes and the cosmological constant, 14:37711 (J;NL)

GENERATORS (PULSE)
See PULSE GENERATORS
GENERATORS (STEAM)
See STEAM GENERATORS
GENES
Generating alignments of genetic sequences, 14:37285 (R;US)
Genetics of early embryo survival, 14:37314 (R;US)
Molecular basis of RNA catalysis. Annual report, March 1988-February 1989, 14:37301 (R;US)
GENETIC ENGINEERING
Recombinant DNA in Japan: current status and future prospects, 14:37302 (R;US)
GENETIC MAPPING
Generating alignments of genetic sequences, 14:37285 (R;US)
GEOCHEMISTRY
Conceptual model for analysing soil and groundwater acidification on regional scale. International symposium on acidification and water pathways, 14:37239 (RA;NO)
Precipitaton, surface and subsurface water chemistry in a tolerant hardwood forest basin, 14:37262 (RA;NO)
GEOCHRONOLOGY
See AGE ESTIMATION
GEOLOGIC FRACTURES
Comparison of spectral data gathered from a laboratory spectrometer and TM images with and without shadow correction, 14:37404 (R;US)
GEOMAGNETIC STORMS
See MAGNETIC STORMS
GEOTHERMAL ENERGY
A discrete fracture model for a hot dry rock geothermal reservoir, 14:35941 (R;US)
GEOTHERMAL POWER PLANTS
An economic prefeasibility study of geothermal energy development at Platonares, Honduras, 14:35940 (R;US)
GEOTHERMAL RESOURCES
An economic prefeasibility study of geothermal energy development at Platonares, Honduras, 14:35940 (R;US)
Central American resource studies, 14:36236 (R;US)
GEOTHERMAL WELLS
Influence of natural fractures on hydraulic fracture propagation, 14:35634 (B;US)
GERMAN FEDERAL REPUBLIC
See FEDERAL REPUBLIC OF GERMANY
GERMANIUM
Ab-initio calculation of the microscopic properties of a grain boundary in germanium, 14:36487 (BA;FR)
Critical phenomenon and segregation behavior at interfaces and subgrain boundaries, 14:36540 (BA;FR)
Grain boundaries and antiphase boundaries in GaAs, 14:36670 (BA;FR)
Grain boundary electrical activity of n-type germanium, 14:36532 (BA;FR)
Grain-boundary dislocations structure and movement in Σ=9 studied by HREM, 14:36496 (BA;FR)
Structure of Ag, Fe and Ge microclusters, 14:37477 (J;DE)
GERMANIUM 72
Lifetime of the O_2^+ state of ^{72}Ge, 14:37584 (RA;ZA;In Afrikaans)
GERMANIUM ALLOYS
See also GERMANIUM BASE ALLOYS
Permittivity relaxation in $Pb_{1-x}Ge_xTe$, 14:36558 (RA;SU;In Russian)
GERMANIUM BASE ALLOYS
Neutron diffraction study of crystal structure of Ge_4Na, Ge_4K, Ge_4Rb, and Ge_4Cs, 14:36548 (RA;SU;In Russian)
GERMANY (FEDERAL REPUBLIC)
See FEDERAL REPUBLIC OF GERMANY
GIANT CELLS
See TUMOR CELLS
GIANT RESONANCE
Excitation of the Δ resonance in heavy ion charge exchange reactions, 14:37628 (R;FR)
GLASS
See also BOROSILICATE GLASS
Leaching of vitrified high-level-active-waste in a near reality simulated repository system. Final report, 14:35789 (R;DE;In German)
Surface reactions of natural glasses, 14:35821 (BA;US)
The use of glass slides for preparing cross-section TEM samples of discrete transistors, 14:36687 (BA;US)
Transparent glass ceramics doped by chromium(iii) and chromium(iii) and neodymium(iii) as new materials for lasers and luminescent solar concentrators. Final report, 1 October 1985-30 June 1988, 14:35928 (R;IL)
GLASS DOSEMETERS
See RPL DOSEMETERS
GLASSY METALS
See METALLIC GLASSES
GLAUBER'S SALT
See SODIUM SULFATES
GLOBAL RISK
See HAZARDS
GLUCOSE
Glucose yields from the solvolysis of wood and pure cellulose by anhydrous Hydrogen Fluoride vapor, 14:35869 (BA;US)
Quantitative infrared spectroscopy of glucose in blood using partial least-squares analyses, 14:37300 (R;US)
Wood sugars to energy-intensive organic chemicals: Phase 1. Final report, 14:35858 (R;US)
GOBAR GAS
See METHANE
GOLD
Common factors controlling grain and phase boundary energy, 14:36517 (BA;FR)
Contribution of lattice matching to the interfacial energy between dissimilar materials, 14:36622 (BA;FR)
Determination of trace gold in rocks and minerals by neutron activation analysis, 14:36705 (R;CN;In Chinese)
EBIC and DLTS measurements of SI- and polycrystalline silicon, 14:36673 (BA;FR)
High resolution electron microscopy studies of the atomic structure of interfaces in magnetic sandwiches, 14:36494 (BA;FR)
Interdiffusion of Au/Ni/Cr on silicon substrate, 14:36529 (BA;FR)
Optical properties of metals and alloys: Au, Ag, FeRh, $AuAl_2$, and $PtAl_2$, 14:36604 (D;US)
Present limitations on the lattice imaging of grain boundaries, 14:37668 (BA;FR)
X-ray diffraction studies of the structure and properties of grain boundaries, 14:36485 (BA;FR)
GOLD 187
Shape coexistence at high spin in ^{187}Au, 14:37593 (R;FR)
GOLD 197 TARGET
Attained energy densities and neutral pion spectra in nucleus-nucleus collisions at 200 GeV/nucleon, 14:37597 (R;US)
Excitation and multiple dissociation of projectiles at intermediate energy, 14:37599 (R;US)
Heavy ion reaction studies of Nb_Au at E/A = 50, 75 and 100 MeV, 14:37600 (J;NL)
Multiplicity fluctuations in finite rapidity windows. Intermittency or quantum statistical correlation?, 14:37540 (J;NL)
Survey of results from Brookhaven Experiment 802 at the AGS, 14:37596 (R;US)
GOLD ALLOYS
Optical properties of metals and alloys: Au, Ag, FeRh, $AuAl_2$, and $PtAl_2$, 14:36604 (D;US)
TEM determination of incoherent twin-boundary structure in $L1_2$ ordered alloys, 14:36497 (BA;FR)
GONADS
Comparative radiosensitivity of oocytes of various stages of maturity, 14:37361 (RA;SU;In Russian)
GRADED LIE GROUPS
Canonical integration and analysis of periodic maps using non-standard analysis and life methods, 14:37709 (R;US)
GRAIN ALCOHOL
See ETHANOL

GRAIN BOUNDARIES
Chemical Reactions
Grain boundary chemistry contributions to intergranular hot cracking, 14:36513 (BA;FR)
Computerized Simulation
Computer simulation of special grain boundaries in metals and ionic materials, 14:37692 (BA;US)
Corrosion
Role of grain boundary structure on the electrochemical stability of passive films formed on high purity polycrystalline nickel, 14:36520 (BA;FR)
Cracks
Hydrogen embrittlement in grain boundaries studied by fatigue crack propagation in Al-Zn-Mg bicrystals, 14:36987 (BA;FR)
Design
Grain boundary design for desirable mechanical properties, 14:37674 (BA;FR)
Diffusion
Effect of high pressures on the mobility of atoms in grain boundaries, 14:36516 (BA;FR)
Dislocations
Grain boundary structure in HCP metals, 14:36490 (BA;FR)
Electronic Structure
Ab-initio calculation of the microscopic properties of a grain boundary in germanium, 14:36487 (BA;FR)
Molecular statics studies of grain boundaries: structure and energy of (001) twist boundaries, 14:37665 (BA;FR)
Segregation energies of phosphorus and sulfur in various relaxed structures of grain boundaries in Ni by tight-binding approximation, 14:36509 (BA;FR)
Embrittlement
Controlling embrittlement at grain boundaries in intermetallic compounds, 14:37676 (BA;FR)
Fatigue
Cyclic migration and fracture in solid solution alloys, 14:36988 (BA;FR)
Fracture Properties
Effect of manganese on intergranular fracture in low alloy steels, 14:36537 (BA;FR)
Interactions
Dynamic studies of deformation and fracture at grain boundaries, 14:36533 (BA;FR)
Mathematical Models
Extended CSL-model for grain boundary in layer structures, 14:37667 (BA;FR)
Mobility of dislocations in grain boundaries, 14:37673 (BA;FR)
Molecular dynamics study of the structure and properties of twist boundaries, 14:36669 (BA;FR)
Present limitations on the lattice imaging of grain boundaries, 14:37668 (BA;FR)
Microstructure
Grain boundary structure and phase transformations: a critical review of computer simulation studies and comparison with experiments, 14:37670 (BA;FR)
Structural analysis and properties of grain boundaries in hexagonal carbides, 14:36628 (BA;FR)
Migration
Dependence of diffusion-induced grain boundary migration on grain boundary structure, 14:36527 (BA;FR)
Diffusion induced grain boundary migration in Ni(Zn) polycrystals, 14:36523 (BA;FR)
Effect of high pressures on the mobility of atoms in grain boundaries, 14:36516 (BA;FR)
Effect of the triple junction on grain-boundary sliding in aluminum tricrystals, 14:36524 (BA;FR)
Strain-induced boundary migration (SIBM) in aluminum bicrystals each with a (211) tilt boundary, 14:36525 (BA;FR)
TEM study of diffusion-induced grain boundary migration in Ni-Cu diffusion couples, 14:36530 (BA;FR)
Mobility
Grain boundary diffusion of Co and Ni in bicrystalline and polycrystalline NiO, 14:36633 (BA;FR)
Migration of differently oriented grain boundaries measured on Fe-3wt%Si 37° (001) bicrystals, 14:36522 (BA;FR)
Phase Studies
TEM determination of incoherent twin-boundary structure in $L1_2$ ordered alloys, 14:36497 (BA;FR)
Phase Transformations
Search for experimentally observed grain boundary phase transitions, 14:36498 (BA;FR)
Potential Energy
Energy and structure of [100] aluminum grain boundary, 14:36519 (BA;FR)
Potentials
Measurements of the elastic constants, the specific heat and the entropy of grain boundaries by means of ultra-fine grained materials, 14:36541 (BA;FR)
Spatial Distribution
Influence of doping elements on the grain boundary characteristics in alumina, 14:36632 (BA;FR)
Stresses
Effect of grain-boundary structure on stress corrosion cracking in αCu-Al alloy bicrystals, 14:36536 (BA;FR)
Symmetry
The topological structure of grain boundaries, 14:36477 (R;US)
Thermodynamic Properties
Grain boundary structure and phase transformations: a critical review of computer simulation studies and comparison with experiments, 14:37670 (BA;FR)
Viscosity
Grain boundary internal friction and relationship to intergranular fracture, 14:36521 (BA;FR)
GRAND UNIFIED THEORY
Couplings in the heterotic superconformal three generation model, 14:37529 (R;DK)
GRANITES
See also PEGMATITES
Index of granitic rock masses in the state of Nevada: A compilation of data on 205 areas of exposed granitic rock masses in Nevada, 14:37407 (R;US)
GRANULATION (SOLAR)
See SOLAR GRANULATION
GRAPHITE
Compton profile of graphite and lithium-intercalated graphite, 14:36684 (BA;US)
Development of a thin wall graphite/polyimide composite pressure vessel with a large aspect ratio, 14:36884 (R;US)
The texture variation in extruded graphite, 14:36663 (R;US)
Two dimensional phase equilibria at surfaces, 14:37671 (BA;FR)
GRAPHITE FIBERS
See CARBON FIBERS
GRAPHITE MODERATOR
See GRAPHITE
GRASERS
See GASERS
GRAVITATIONAL FIELDS
Macroscopic constraints on string unification, 14:37548 (R;US)
GRAVITATIONAL LENSES
Gravitational lensing and finite beam-width effect on cosmic microwave anisotropies, 14:37442 (R;JP)
GREAT BRITAIN
See UNITED KINGDOM
GREAT LAKES
A large-sample extractor for determining organic contaminants in the Great Lakes, 14:37257 (R;CA)
GREAT LAKES REGION
See FEDERAL REGION V
GREENHOUSE EFFECT
Effects of climatic change on agricultural land resource potential, 14:37167 (RA;CA)
Experiences in modelling water and land resources within a climate change framework, 14:37166 (RA;CA)
GREENHOUSES
Large scale illumination using prism light guide and a Vortek lamp, 14:36399 (R;CA)
GRINDING MACHINES
Coal disintegration by high-pressure waterjet: Final report, 14:35514 (R;US)

Energy conservation in the industrial minerals sector. Comminution - Phase 3. Activity 4: monitoring and control of a dry grinding circuit using a particle size analyzer and programmable controllers, 14:36411 (R;CA)

GROUND DISPOSAL
Guide to land treatment of municipal waste water in Illinois, 14:36433 (R;US)

GROUND MOTION
Geotechnical instrument tation of the AOSTRA mine-assisted underground steaming trial, 14:35720 (RA;CA)

GROUND RELEASE
Test emission of uranium hexafluoride in atmosphere. Results interpretation, 14:37198 (R;FR;In French)

GROUND SOURCE HEAT PUMPS
Capacity of saturated or unsaturated soil to restore calories by gelation, 14:36202 (RA;CA;In English and French)

GROUND STATES
Spin value of ^{184}Ir ground state, 14:37627 (R;FR)

GROUND WATER
Acidification
Acidification and water pathways. What about the future?, 14:37273 (RA;NO)
Effects of air pollutants on groundwater quality in the Federal Republic of Germany, 14:37241 (RA;NO)
Precipitaton, surface and subsurface water chemistry in a tolerant hardwood forest basin, 14:37262 (RA;NO)

Chemical Composition
Conceptual model for analysing soil and groundwater acidification on regional scale. International symposium on acidification and water pathways, 14:37239 (RA;NO)
Size distribution patterns for trace elements in waters draining a small catchment, S.E. Norway, 14:37263 (RA;NO)

Contamination
Assessment of Basalt Waste Isolation Project's borehole mud pits soils and sediments for chemical constituents: Summary report, 14:35814 (R;US)
Liquid effluent study project plan, 14:35815 (R;US)

Corrosive Effects
Corrosion aggressiveness og groundwaters on the underground route in Warsaw, 14:37269 (RA;NO)

Flow Rate
Numerical modeling and tracer study of groundwater—Yenliao Nuclear Power Plant site, Taipei, Taiwan, June 5–12, 1988: Foreign trip report, 14:35796 (R;US)

Hydrology
Influence of spatial discretization in 3D groundwater flow calculations using the finite-element method, 14:37248 (R;SE)

Mathematical Models
Demonstration of a performance assessment methodology for high-level radioactive waste disposal in basalt formations, 14:35792 (R;US)
Systems analysis, long-term radionuclide transport, and dose assessments, Waste Isolation Pilot Plant (WIPP), southeastern New Mexico; March 1989, 14:35811 (R;US)

Monitoring
Managing data from a large-scale groundwater monitoring program, 14:37255 (R;US)

Nitrates
Fiscal year 1987 program report (Massachusetts Water Resources Research Center). Annual report, 14:37280 (R;US)

Ph Value
Attenution of acidity in groundwater flow systems, 14:37260 (RA;NO)

Recharge
Guide to land treatment of municipal waste water in Illinois, 14:36433 (R;US)

Water Pollution
Corrosion aggressiveness og groundwaters on the underground route in Warsaw, 14:37269 (RA;NO)
Drum centrifuge modelling of long-term pollutant migration through a soil layer, 14:37222 (R;GB)
Use of industrial-hygiene samplers for soil-gas measurement, 14:37221 (R;US)

Water Quality
Corrosion aggressiveness og groundwaters on the underground route in Warsaw, 14:37269 (RA;NO)

GROUND-WATER RESERVES
See AQUIFERS

H

HABITAT
Assessing the opportunity cost of fish mitigation activities in the Columbia River Basin, 14:35888 (RA;US)
Data needs for proposed pilot study, 14:35889 (RA;US)
Feasibility of implementing the least-cost model, 14:35887 (RA;US)

HADRON REACTIONS
Inclusion of correlations in the empirical selection of intranuclear cascade nucleons from high energy hadron-nucleus collisions, 14:37127 (J;NL)

HADRON-HADRON INTERACTIONS
Complete computation of high-p_T W and Z production in second-order QCD, 14:37536 (J;NL)

HAFNIUM
Health-hazard evaluation determination report No. 74-78-297, Amax Speciality Metals, Parkersburg, West Virginia, 14:37185 (R;US)
Low-temperature isotopic exchange in molecular hydrogen on films of transition and rare earth metals and their alloys with copper, 14:36813 (RA;SU;In Russian)

HAFNIUM 179
Intensive two-quantum cascades and fragmentation of quasiparticle states in some deformed nuclei, 14:37633 (R;SU;In Russian)

HAFNIUM ALLOYS
Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1, 14:35538 (R;US)
Low-temperature isotopic exchange in molecular hydrogen on films of transition and rare earth metals and their alloys with copper, 14:36813 (RA;SU;In Russian)

HAFNIUM COMPLEXES
Electron structure and electrostatic potential of some neutral organophosphorus extractants and their complexes, 14:36818 (RA;SU)

HAFNIUM OXIDES
Phase relationships in high-temperature ceramics. Phase 1. Final report, 14:36610 (R;US)

HALIDES
See also BROMIDES
CHLORIDES
Metastable ordered compounds formed during epitaxial growth, 14:36539 (BA;FR)

HALL GENERATORS
See MHD GENERATORS

HANDLING (DATA)
See DATA PROCESSING

HANDLING (WASTES)
See WASTE MANAGEMENT

HANFORD RESERVATION
Assessment of Basalt Waste Isolation Project's borehole mud pits soils and sediments for chemical constituents: Summary report, 14:35814 (R;US)
Effective transition from panel board to CRT-based process control, 14:35776 (RA;US)
Hanford Environmental Dose Reconstruction Project: Monthly report, 14:37382 (R;US)

HARDNESS
Description of the Nano∆Indenter™; An ultra-low-load microhardness indentation test machine, 14:36996 (R;US)

HAZARDOUS MATERIALS
Health-hazard evaluation determination report No. 75-178-295, New York Telephone and Telegraph Company, 770 Broadway, New York, New York, 14:37183 (R;US)

Aerosols
Health-hazard evaluation determination report No. 75-109, 110, 112, 114-274, Fairbanks Weighing Division, Colt Industries, St. Johnsbury, Vermont, 14:37182 (R;US)
Dusts
Preliminary survey report: control technology support for sensor, Unimin Corporation, Dividing Creek Sand Plant, Millville, New Jersey, August 16, 1988, 14:37179 (R;US)
Evaluation
Assessment of Basalt Waste Isolation Project's borehole mud pits soils and sediments for chemical constituents: Summary report, 14:35814 (R;US)
Ground Disposal
Liquid effluent study project plan, 14:35815 (R;US)
In-Situ Processing
1988 DOE model conference proceedings: Volume 5, 14:35775 (R;US)
Indoor Air Pollution
Health-hazard evaluation determination report No. 74-78-297, Amax Speciality Metals, Parkersburg, West Virginia, 14:37185 (R;US)
Inventories
Methodology for hazardous waste surveys, 14:35779 (R;US)
Iron Oxides
Health-hazard evaluation determination report No. 73-185-256, Electromotive-Division, GMC (Plant 2), Chicago, Illinois, 14:37186 (R;US)
Materials Handling
Methane desorption in coal handling, 14:35548 (R;CA)
Transferring generic SARA/OSHA training to US Department of Energy facilities, 14:35825 (RA;US)
Occupational Exposure
Hazard Communication Project: reference manual, 14:37330 (R;US)
Sample Preparation
The preparation of TEM specimens from hazardous or difficult materials, 14:36681 (BA;US)
Storage
Regulatory requirements important to Hanford single-shell tank waste management decisions, 14:35801 (R;US)
Waste Disposal
1988 DOE model conference proceedings: Volume 1, 14:35771 (R;US)
Cost impact of potential RCRA (Resource Conservation Recovery Act) changes on New York State Utility coal-waste disposal. Final report, 14:35563 (R;US)
Lawrence Livermore National Laboratories Environmental Protection Department 1988 California legislative highlights, 14:36233 (R;US)
Trial-Burn Observation Guide. Final report, 14:36438 (R;US)
Waste Management
Summary report of capacity at commercial facilities. Volume 1. Summary report, 14:36435 (R;US)
Summary report of capacity at limited commercial and company-captive facilities. Volume 1. Draft report, 14:36436 (R;US)
Summary report of capacity at limited commercial and company-captive facilities. Volume 2. Draft report, 14:36437 (R;US)
Water Pollution
Persistent Marine Debris, challenge and response: the Federal perspective, 14:37274 (R;US)

HAZARDS
See also HEALTH HAZARDS
Insurance and bonding, 14:37401 (R;US)

HCLWR TYPE REACTORS
Critical heat flux (CHF) characteristics of high conversion pressurized water reactor with double flat core, 14:36010 (R;JP;In Japanese)

HD 8077
See NICKEL BASE ALLOYS

HDEHP
Low-coverned nature of association (micellation) of dialkylphosphates in water and organic phases and their manifestation in the process of metal extraction with dialkylphosphoric acid (Solvent extraction of cadmium compounds.), 14:36829 (RA;SU)
Mechanism of extraction of uranium (6) by mixtures of phosphororganic extractants, 14:36864 (RA;SU)
Mechanism of nitric acid and strontium extraction with zirconium di-2-ethylhexyl phosphate complexes-studying by the ^{14}N and ^{31}P NMR methods, 14:36837 (RA;SU)
Study of salting effect of D2EHPA in chloride solutions, 14:35765 (RA;SU)

HEALTH HAZARDS
See also RADIATION HAZARDS
Hazard Communication Project: reference manual, 14:37330 (R;US)

HEALTH PHYSICS
See RADIATION PROTECTION

HEAT EXCHANGERS
See also FLUIDIZED BED HEAT EXCHANGERS
Compact ceramic heat exchangers. Final report, February 1983-June 1988, 14:35688 (R;US)
Heat exchanger development for steam-injected Brayton cycle: Final report for period September 30, 1984 to April 30, 1988, 14:36577 (R;US)
Transient response of an in-ground vertical cylindrical heat exchanger. Thermal characterization of the soil, 14:36199 (RA;CA;In French)

HEAT PUMPS
See also GROUND SOURCE HEAT PUMPS
WATER SOURCE HEAT PUMPS
Potential of electric heat pumps for heating water in South Africa, 14:36391 (R;ZA)
Research and development on a 3-kW-class Stirling engine, 14:36390 (R;JP)
[Working meeting of the International Energy Agency Annex 14 on Working fluids and transport phenomena in advanced absorption heat pumps, May 28-30, 1989, Stockholm, Sweden; May 31, 1989, Nykoping, Sweden; June 5, 1989, Stuttgart, West Germany; June 6, 1989, Essen, West Germany; June 7, 1989, Munich, West Germany]: Foreign trip report, 14:36389 (R;US)

HEAT RESISTING ALLOYS
Diffusion reactions between silicon oxynitride and silicon nitride during HIP-synthesis, 14:36625 (BA;FR)

HEAT SOURCES
Open cycle heat pump development: Phase II, District heating case study analysis: Progress report, October 1988–December 31, 1988, 14:36424 (R;US)

HEAT STORAGE
See also SEASONAL THERMAL ENERGY STORAGE
SENSIBLE HEAT STORAGE
THERMOCHEMICAL HEAT STORAGE
Heat storage R&D in The Netherlands, 14:36243 (RA;CA;In English and French)
Model of a heating installation consisting of solar collectors, storage tank and heat pump, 14:35937 (RA;CA;In English and French)
Presentation of a software package for automated evaluation of soil heat storage projects, 14:36210 (RA;CA;In French)

HEAT STORAGE DEVICES
See THERMAL ENERGY STORAGE EQUIPMENT

HEAT STORAGE SYSTEMS
See THERMAL ENERGY STORAGE EQUIPMENT

HEAT TRANSFER
Pressure drop and heat transfer characteristics of nearly neutrally buoyant particulate slurry for advanced energy transmission fluids, 14:36976 (R;US)

HEAT TRANSFER FLUIDS
Pressure drop and heat transfer characteristics of nearly neutrally buoyant particulate slurry for advanced energy transmission fluids, 14:36976 (R;US)

HEAT TRANSMISSION
See HEAT TRANSFER

HEATED EFFLUENTS
See THERMAL EFFLUENTS

HEATING SYSTEMS
See also SOLAR HEATING SYSTEMS

OPENSOL. Software for the optimization of sizing and control of complex heating systems with long-term heat storage, 14:36381 (RA;CA;In French)

HEAVY ION REACTIONS
See also ARGON 40 REACTIONS
KRYPTON 86 REACTIONS
MOLYBDENUM 100 REACTIONS
NIOBIUM 93 REACTIONS
OXYGEN 16 REACTIONS
OXYGEN 17 REACTIONS
SULFUR 32 REACTIONS
Attained energy densities and neutral pion spectra in nucleus-nucleus collisions at 200 GeV/nucleon, 14:37597 (R;US)
Compressional effects in heavy ion collisions: spinodal decomposition and thermal energy saturation, 14:37608 (R;FR)
Investigation of relativistic heavy ion interactions with the atomic nuclei, 14:37623 (R;RO;In Romanian)
Measurement and statistical model analysis of pre-fission neutron multiplicities, 14:37606 (R;AU)
Plastic Ball experiments, 14:37110 (R;DE)
Transverse energy scaling and energy density estimates from ^{16}O- and ^{32}S-induced reactions, 14:37562 (R;US)
$K^{\pm}$, p^{-}, and Ω^{-} production in relativistic heavy ion collisions, 14:37638 (J;US)

HEAVY LEPTONS
Review of "close-mass" heavy lepton searches, 14:37514 (R;US)

HEAVY NUCLEI
See also GOLD 187
IRIDIUM 184
MERCURY 185
POLONIUM 210
RADIUM 218
RADON 222
Consistent systematics of nuclear level densities for mean and heavy nuclei, 14:37612 (RA;XA)

HEAVY OILS
See PETROLEUM

HELIOSTATS
An improved design for stretched-membrane heliostats, 14:35926 (R;US)

HELIUM
Energy eigenvalues of helium-like atoms in dense plasmas, 14:37731 (R;JP)
Structural characteristics of proposed ITER TF coil conductor, 14:36930 (J;US)
The effect of transverse stress on the critical current of Nb_3Sn cable-in-conduit superconductors, 14:36931 (J;US)

HELIUM 3 TARGET
Evaluation of total interaction cross-sections for nuclei with mass number 3, 14:37610 (RA;XA)

HELIUM COOLED REACTORS
See also HTTR REACTOR
Thermal-hydraulic simulation of helium expulsion from a cable-in-conduit conductor, 14:36916 (J;US)

HERA STORAGE RING
Manufacture and testing of 465 km superconducting cable for the HERA dipole magnets, 14:36919 (J;US)
Training in test samples of superconducting cables for accelerator magnets, 14:36933 (J;US)

HERBS
Response of wetland herb communities to gradients of disturbance and substrate, 14:37214 (J;US)

HETEROJUNCTIONS
Phonon-drag thermoelectric power in high magnetic fields in heterojunctions, 14:37689 (R;US)

HFS
See HYPERFINE STRUCTURE

HIFAR REACTOR
Current HIFAR operations, 14:36122 (RA;AU)
First quarterly report of the Nuclear Safety Bureau for the period 19 October 1987 to 18 January 1988, 14:36123 (R;AU)
HIFAR - project organization design and procurement, 14:36117 (RA;AU)
HIFAR : aspects of construction - United Kingdom and Australia, 14:36118 (RA;AU)
HIFAR commissioning and operation 1955-1962, 14:36121 (RA;AU)
HIFAR refurbishing program, 14:36148 (RA;AU)
Instrumentation and control aspects of HIFAR, 14:36120 (RA;AU)
Second quarterly report of the Nuclear Safety Bureau for the period 19 January 1988 to 18 April 1988, 14:36124 (R;AU)
Some aspects of HIFAR design, 14:36119 (RA;AU)
Symposium on HIFAR - construction and initial operation, 14:36116 (R;AU)

HIGGS BOSONS
Present and future searches for the Higgs Boson with the MEVVA high current metal ion source, 14:37527 (R;US)

HIGH ENERGY PHYSICS
Glueballs, hybrids, and exotic hadrons, 14:37490 (B;US)
High-energy physics. Panorama of programs. Description of the problem situation, 14:37518 (R;SU;In Russian)
Progress report for a research program in computational physics, 14:37492 (R;US)
Progress report for a research program in theoretical high energy physics, 14:37493 (R;US)
Progress report of a research program in experimental high energy physics, January 1, 1989–December 31, 1989, 14:37500 (R;US)
Progress report of a research program in experimental high energy physics: Task B: Progress report, January 1–December 31, 1989, 14:37501 (R;US)
Proposed activity - Budget for research in high energy physics: Technical progress report, January 1, 1990–December 31, 1994, 14:37491 (R;US)
Report of the kaon subcommittee of nuclear science advisory committee: Final report, 14:37496 (R;US)
Research in elementary particle physics: Technical progress report, June 1, 1988–May 31, 1989, 14:37494 (R;US)
[Studies of elementary particles and high energy phenomena: [Progress report], 14:37495 (R;US)

HIGH ENERGY RADIOTHERAPY
See RADIOTHERAPY

HIGH FLUX AUSTRALIAN REACTOR
See HIFAR REACTOR

HIGH FLUX NEUTRON SOURCE FACILITY
See NEUTRON SOURCE FACILITIES

HIGH SPIN STATES
High lying and high spin states in heavy nuclei via transfer reactions, 14:37629 (R;FR)

HIGH TEMPERATURE GAS COOLED AND GRAPHITE MODERATED REACTORS
See HTGR TYPE REACTORS

HIGH-BETA PLASMA
Homeostasis in plasma confinement at beta close to unity, 14:37728 (R;JP)

HIGH-LEVEL RADIOACTIVE WASTES
Containers
A database for reviews and evaluations of high-level waste documents, 14:35820 (BA;US)
Nuclear waste package container corrosion in simulated salt repository environments, 14:35819 (BA;US)
Data Base Management
A database for reviews and evaluations of high-level waste documents, 14:35820 (BA;US)
Radioactive Waste Processing
Evaluation of minimum-fluidizing velocity correlations for bed particles used in fluidized-bed calcination processes, 14:35816 (R;US)
Radionuclide Migration
Leaching of vitrified high-level-active-waste in a near reality simulated repository system. Final report, 14:35789 (R;DE;In German)
Transport
Cask drop testing and analysis, 14:36869 (R;US)
Investigation of cask contamination weeping: A progress report, 14:36888 (R;US)
TRUPACT I filter development: Status report, 14:36883 (R;US)

Underground Disposal
A synopsis of analyses (1981–87) performed to assess the stability of underground excavations at Yucca Mountain: Yucca Mountain Project, 14:35808 (R;US)
An evaluation of near-field host rock temperatures for a spent fuel repository, 14:35805 (R;US)
Analysis of alternative waste isolation concepts, 14:35795 (R;US)
Demonstration of a performance assessment methodology for high-level radioactive waste disposal in basalt formations, 14:35792 (R;US)
MRS system study summary report, 14:35783 (R;US)
Preliminary analyses in support of in situ thermomechanical investigations, 14:35809 (R;US)
Systems analysis, long-term radionuclide transport, and dose assessments, Waste Isolation Pilot Plant (WIPP), southeastern New Mexico; March 1989, 14:35811 (R;US)
Thermal-conductivity data for tuffs from the unsaturated zone at Yucca Mountain, Nevada: Yucca Mountain Project, 14:35807 (R;US)
Waste Isolation Pilot Plant brine field pH measurements: Technique and interpretation, 14:35810 (R;US)
Underground Storage
Tank farm surveillance and waste status summary report for April 1989, 14:35813 (R;US)
Waste Disposal
1988 DOE model conference proceedings: Volume 1, 14:35771 (R;US)
Waste Transportation
Design considerations for on-site spent-fuel transfer systems: Final report, 14:35767 (R;US)

HIGH-VOLTAGE PULSE GENERATORS
Performance of the 10kV, 100-kA pulsed-power modules for the FRX-C magnetic compression experiment, 14:37771 (R;US)

HIGHWAYS
See ROADS

HISTORICAL ASPECTS
History of the application of the generalized Lewis acid-base theory to metals, 14:36575 (R;US)

HOG FUEL
See WOOD WASTES

HOLMIUM OXIDES
Anisotropies in the magnetic penetration depth and critical current density of $R_1Ba_2Cu_3O_{7-x}$ (R = Y or Ho), measured on magnetically-aligned powder composites, 14:36952 (J;US)

HORIZONTAL AXIS TURBINES
Three-dimensional airfoil performance measurements on a rotating wing, 14:35952 (R;US)

HOSPITALS
Health-hazard evaluation determination report No. 75-151-259, Winchester Hospital, Winchester, Massachusetts, 14:37184 (R;US)
Radiology PRICER 2.0 subroutine installation guide, Volume 1 and Volume 2, 14:37322 (R;US)
Radiology PRICER 2.0 subroutines for RADMAIN and RADPRICE. Software, 14:37321 (R;US)

HOT GAS CLEANUP
5-MW Toronto HALT [Hydrate Addition at Low Temperature] pilot plant testing: Test results: Part 1-A, 14:35958 (R;US)

HOT PLASMA
Axisymmetric particle-in-cell simulations of diamagnetic-cavity formation in vacuum, 14:37784 (J;US)
Magnetic field-aligned plasma expansion in critical ionization velocity space experiments, 14:37459 (J;US)

HOT WATER HEATERS
See WATER HEATERS

HOT-DRY-ROCK SYSTEMS
Reservoir water loss modeling and measurements at Fenton Hill, New Mexico, 14:35942 (R;US)

HOT-WATER PROCESSES
Athabasca mineable oil sands. The RTR/Gulf extraction process theoretical model of bitumen detachment, 14:35717 (RA;CA)

HOUSEHOLDS
Energy typologies. Energy expenditures of Canadians, 1969-1982, 14:36231 (R;CA;In French)

HOUSES
Conversion of detached houses with direct electric heating to district heating, 14:36374 (R;SE;In Swedish)
Indoor radon, 14:37199 (R;US)
Integrated thermal storage in energy systems for Canadian low energy houses, 14:36383 (RA;CA;In English and French)
Remote and northern energy-efficient house design catalogue, 14:36380 (R;CA)
Rural and native housing demonstration program. Report and construction manual, 14:36398 (R;CA)

HTGR TYPE REACTORS
See also HTTR REACTOR
Closeout of IE Bulletin 80-09: Hydramotor actuator deficiencies, 14:36164 (R;US)
Fission products plate-out analysis code in the HTGR: PLAIN, 14:36021 (R;JP;In Japanese)
GAVROSh program complex abstract, 14:36020 (RA;SU;In Russian)
HTR research and development in Austria. 1987/1988 progress report, 14:36025 (R;AT)
Investigation and test results of the PNP steam reformer test bundle in the EVA-II-plant, 14:36024 (R;DE;In German)
Methods of power distribution determination using the signals from out-of-pile detectors, 14:36108 (RA;SU;In Russian)
Some problems on an absorber burnup in an infinite half-space, 14:36019 (RA;SU;In Russian)
Study on the reaction between SiC and Pd, (2), 14:36022 (R;JP;In Japanese)
Thermal conduction of high-temperature steel foil shield for HTGR reactor, 14:36017 (RA;SU;In Russian)

HTO
See TRITIUM COMPOUNDS

HTTR REACTOR
Graphite structural design code for the High Temperature Engineering Test Reactor, 14:36023 (R;JP;In Japanese)

HUGENHOLTZ-PINES THEORY
See HYDROGEN

HUMAN CELLS
See ANIMAL CELLS

HUMAN FACTORS
Research in operations: operator reliability experiments, 14:36133 (RA;US)

HUMAN POPULATIONS
Hanford Environmental Dose Reconstruction Project: Monthly report, 14:37382 (R;US)
Nuclear Accidents Intervention Levels for Protection of the Public, 14:36155 (R;XN)

HUMANS
See HUMAN POPULATIONS

HUTCHINSON ISLAND-1 REACTOR
See LUCIE-1 REACTOR

HUTCHINSON ISLAND-2 REACTOR
See LUCIE-2 REACTOR

HYDRATES
See also GAS HYDRATES
5-MW Toronto HALT [Hydrate Addition at Low Temperature] pilot plant testing: Test results: Part 1-A, 14:35958 (R;US)

HYDRAULIC RAMS
See PUMPS

HYDROCARBON FUEL CELLS
Electrochemical conversion of C(1) molecules. Final report, February 1, 1986-December 31, 1988, 14:35861 (R;US)

HYDROCARBONS
See also ANTHRACENE
BENZENE
BIPHENYL
POLYENES
STYRENE
TOLUENE
XYLENES
Changes in pore structure of precipitated iron oxide catalysts during pretreatment and hydrocarbon synthesis reaction, 14:36733 (RA;CA)

Electrochemical conversion of C(1) molecules. Final report, February 1, 1986-December 31, 1988, 14:35861 (R;US)
NOGAP C-11A. Sediment regime of lakes in the Mackenzie Delta, 14:37234 (R;CA)

HYDROCHLORIC ACID
Laboratory testing of a fluidized-bed dry-scrubbing process for the removal of acidic gases from a simulated incinerator flue gas: Final report, 14:36416 (R;US)

HYDROCRACKING
Reaction mechanism in VisABC process, 14:35635 (RA;CA)

HYDRODYNAMICS
Nonlinear hydrodynamical innstabilities, transitions, and coherent features: Final report, 14:37487 (R;US)

HYDROELECTRIC POWER
National Hydroelectric Power Resources Study. Volume 12, 14:35872 (R;US)
Pilot program for water quality data collection by volunteers, 14:35898 (R;US)

HYDROELECTRIC POWER PLANTS
See also SMALL-SCALE HYDROELECTRIC POWER PLANTS
Assessing the cost-effectiveness of alternative mitigation strategies: the simulation model, 14:35885 (RA;US)
Assessing the opportunity cost of fish mitigation activities in the Columbia River Basin, 14:35888 (RA;US)
Canada-Manitoba agreement on the study and monitoring of mercury pollution in the diversion system of the Churchill River. Summary report, 14:35896 (R;CA;In French)
Data needs for proposed pilot study, 14:35889 (RA;US)
Economic analyses of fish mitigation strategies, 14:35884 (RA;US)
Energy regulation, 14:35894 (R;US)
Feasibility of implementing the least-cost model, 14:35887 (RA;US)
Hydropower plant modernization guide: Volume 3, Automation: Final report, 14:35875 (R;US)
Identifying the most cost-effective fish mitigation strategy: the least-cost model, 14:35886 (RA;US)
Juvenile production, 14:35878 (RA;US)
Modeling downstream migration, 14:35879 (RA;US)
Modeling the estuary and early ocean life stanza, 14:35880 (RA;US)
Modeling the late ocean life stanza, 14:35881 (RA;US)
Modeling the upstream migration of adult salmonids, 14:35882 (RA;US)
Overview of models, 14:35877 (RA;US)
Smolt monitoring in the Columbia River Basin, 14:35883 (RA;US)
Systems analysis and the fish and wildlife program, 14:35876 (RA;US)
Water chemistry/water discharge relationships within the Churchill River diversion and Lake Winnipeg regulation region, Manitoba, Canada, 14:35895 (R;CA)

HYDROELECTRICITY
See HYDROELECTRIC POWER

HYDROGEN
A summary of hydrogen-air detonation experiments, 14:36161 (R;US)
An efficient palladium isotope chromatograph (EPIC) for hydrogen, 14:36727 (R;US)
Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1, 14:35538 (R;US)
Hydrogen segregation and diffusion at grain boundaries, 14:36501 (BA;FR)
Structure and reactivity of chemisorbed species and reaction intermediates: Progress report, December 1, 1984–November 30, 1985, 14:36742 (R;US)
Thermodynamic equilibria in the biphenyl/hydrogen system (The power and limitations of group additivity estimations): Topical report, 14:35664 (R;US)

HYDROGEN 1
Catalytic properties of hydride-forming intermetallic compounds in reactions with the participation of hydrogen, 14:36814 (RA;SU;In Russian)
Low-temperature isotopic exchange in molecular hydrogen on films of transition and rare earth metals and their alloys with copper, 14:36813 (RA;SU;In Russian)

HYDROGEN 1 MINUS BEAMS
A high-intensity plasma-sputter heavy negative ion source, 14:37467 (R;US)

HYDROGEN 1 TARGET
Experiments with one-meter hydrogen bubble chamber in beams of relativistic light nuclei, 14:37508 (RA;CS;In Slovak)

HYDROGEN 2
See DEUTERIUM

HYDROGEN 3
See TRITIUM

HYDROGEN CHLORIDES
See HYDROCHLORIC ACID

HYDROGEN COMPLEXES
The structure of the boron-hydrogen complex in silicon, 14:36695 (BA;US)

HYDROGEN HYDROXIDES
See WATER

HYDROGEN ISOTOPES
See also DEUTERIUM
HYDROGEN 1
TRITIUM
Effect of carrier nature and Pt concentration on catalytic properties of deposited catalysts with respect to reaction of homomolecular isotopic exchange of hydrogen, 14:36812 (RA;SU;In Russian)
Homogeneous activation of molecular hydrogen: on the development of effective catalysts for isotopic exchange in protolytic media, 14:36816 (RA;SU;In Russian)

HYDROGEN MINUS 1 BEAMS
See HYDROGEN 1 MINUS BEAMS

HYDROGEN PHOSPHATES
See PHOSPHORIC ACID

HYDROGEN SULFIDES
Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1, 14:35538 (R;US)
Results of fisheries investigations in Douglas tailwater, August 1987–September 1988, 14:35897 (R;US)

HYDROGENATION
Thermodynamic equilibria in the biphenyl/hydrogen system (The power and limitations of group additivity estimations): Topical report, 14:35664 (R;US)

HYDROLOGY
Hydrologic and chemical characteristics of darkwater, clearwater and acidic lakes in the United States, 14:37267 (RA;NO)
Hydrologic system characterisation for biogeochemical process research in forest ecosystems, 14:37236 (RA;NO)
Influence of spatial discretization in 3D groundwater flow calculations using the finite-element method, 14:37248 (R;SE)

HYDROXYL IONS
See ANIONS

HYPERFINE STRUCTURE
Shape transition in neutron deficient PT isotopes, 14:37592 (R;FR)

HYPERONS
Hyperon production with antiprotons, 14:37503 (R;US)

HYPOXIA
See ANOXIA

I

IAEA
Nuclear power safety, 14:36145 (R;US)
Tenth working group meeting of representatives of RCA Member States. Report, 14:37788 (R;XA)

IAEA AGREEMENTS
Agreement of 27 September 1988 between the International Atomic Energy Agency and the Government of India for the application of safeguards in connection with the supply of a

nuclear power station from the Union of Soviet Socialist Republics, 14:35837 (R;XA)

IAEA SAFEGUARDS
Agreement of 27 September 1988 between the International Atomic Energy Agency and the Government of India for the application of safeguards in connection with the supply of a nuclear power station from the Union of Soviet Socialist Republics, 14:35837 (R;XA)

IBM COMPUTERS
Computer based training state of the art systems, 14:35826 (RA;US)

ICE
An annual storage ice system for summer cooling, 14:36209 (RA;CA;In English and French)
Cooling with ice. Canadian progress, 14:36204 (RA;CA;In English and French)
Ice production using ambient winter temperatures, 14:36205 (RA;CA;In English and French)
Precooling vegetables using a block of ice produced by winter coolness., 14:36415 (RA;CA;In English and French)
The "Fabrikaglace" process to make and store natural ice, 14:36208 (RA;CA;In English and French)

ICRP CRITICAL GROUP
Optimization of radiation protection, 14:35832 (RA;CA)

IDAHO
The hydrothermal system in central Twin Falls County, Idaho, 14:35938 (R;US)

IDAHO ADVANCED TEST REACTOR
See ATR REACTOR

IDAHO NATIONAL ENGINEERING LABORATORY
Managing training to maximize employee articulation, 14:35829 (RA;US)

IDENTIFICATION SYSTEMS
An evaluation of the polyester/polyethylene badge packet as an identification card, 14:37792 (R;US)

IEA
See INTERNATIONAL ENERGY AGENCY

ILLUMINATION SYSTEMS
See LIGHTING SYSTEMS

IMAGE PROCESSING
On incompleteness of interpretation rules for some diagnostic images, 14:37319 (RA;SU;In Russian)
Target cueing and tracking system for safeguards and security, 14:35851 (R;US)

IMIDAZOLES
Supercritical fluid thermodynamics for coal processing: Quarterly progress report, September 15, 1988–December 31, 1988, 14:35529 (R;US)

IMIDES
Chemistry and microstructure at metal-polymer interfaces, 14:36668 (BA;FR)
Development of a thin wall graphite/polyimide composite pressure vessel with a large aspect ratio, 14:36884 (R;US)

IMMOBILIZED CELLS
Immobilization of unicellular marine organisms for optical characterization, 14:37251 (BA;US)

IMMUNE TOLERANCE
See IMMUNITY

IMMUNITY
Combined effect of internal irradiation, alcohol and smoking on some immunological indices, 14:37374 (RA;SU;In Russian)

IMPERMEABLE DRY ROCK
See HOT-DRY-ROCK SYSTEMS

IMPORTS
Oil use and oil dependency: Long-term issues, 14:35654 (R;US)

IN-SERVICE INSPECTION
Application of generic PRA insights to NRC inspection, 14:36181 (BA;DE)
Generic safety insights for inspection of boiling water reactors, 14:36179 (BA;DE)

IN-SITU COMBUSTION
A pressure observation well for monitoring and optimizing the pressure-up blowdown combustion process, 14:35711 (RA;CA)
Aspects of alloy selection in thermal recovery of heavy crudes and tar sands, 14:36467 (RA;CA)
Oil sands formation preheating study, 14:35714 (RA;CA)

IN-SITU GASIFICATION
Underground coal gasification program plan, FY 1989, 14:35522 (R;US)

INCINERATION
See COMBUSTION

INCINERATORS
See also WATERWALL INCINERATORS
Structural-engineering studies on the use of filter dusts from waste-incinerator flue gas cleaning as an aggregate bitumen in road construction, 14:36420 (R;DE;In German)
Trial-Burn Observation Guide. Final report, 14:36438 (R;US)

INCLUSION COMPLEXES
See CLATHRATES

INCLUSIONS
Applications of inclusion in separation science, 14:35915 (BA;US)

INCOLOY 800
Fracture mechanics investigations for components of the steam cycle in an HTR electricity producing plant, 14:36571 (R;DE;In German)

INCOLOY 800H
Heat exchanger development for steam-injected Brayton cycle: Final report for period September 30, 1984 to April 30, 1988, 14:36577 (R;US)

INCOMPRESSIBLE FLOW
Dynamics of colloidal dispersions via lattice-gas models of an incompressible fluid, 14:37488 (R;US)

INCONEL 600
Cracking of Alloy 800 tubing in superheated steam sections of the solar one central receiver, 14:36591 (BA;US)
Evaluation of SCC test methods for Inconel 600 in low-temperature aqueous solutions, 14:36175 (BA;US)
Role of residual stress in stress corrosion cracking in Alloy 600 tubes - Part I, 14:36592 (BA;US)

INCONEL 617
Heat exchanger development for steam-injected Brayton cycle: Final report for period September 30, 1984 to April 30, 1988, 14:36577 (R;US)

INCONEL 718
Microstructure and stress corrosion resistance of alloys X-750, 718, and A-286 in LWR environments: Final report, 14:36544 (R;US)

INCONEL X750
Microstructure and stress corrosion resistance of alloys X-750, 718, and A-286 in LWR environments: Final report, 14:36544 (R;US)

INDIA
Agreement of 27 September 1988 between the International Atomic Energy Agency and the Government of India for the application of safeguards in connection with the supply of a nuclear power station from the Union of Soviet Socialist Republics, 14:35837 (R;XA)
Indoor spatial monitoring of combustion-generated pollutants (TSP, CO, and BAP) by Indian cookstoves, 14:37162 (R;US)
Seismic zoning in India, 14:37408 (R;XA)

INDIUM
A test system for thermomechanical fatigue of solder joints, 14:36585 (R;US)
Novel approaches to ionic chromatography: Progress report, December 1, 1987–June 30, 1989, 14:36707 (R;US)

INDIUM COMPLEXES
Hydration and solvation energies and thermodynamic distribution coefficient of some extraction systems (Extraction systems: TBP-UO_2Cl_2($ThCl_4$)-HCL; AA-$InCl_3$-HCl, where AA-acetylacetone.), 14:36825 (RA;SU)
Ir, NMR and conductivity study of extracts and the character of the mutual influence of metals in their extraction with alkylammonium salts, 14:36716 (RA;SU)

INDIUM PHOSPHIDES
Absolute pressure derivatives of deep level defects in III-V semiconductors, 14:36697 (BA;US)

INDIUM SELENIDE SOLAR CELLS
Materials analysis and device optimization of $CuInSe_2$ solar cells: Annual subcontract report, 16 January 1987–15 January 1988, 14:35913 (R;US)
Two-terminal $CuInSe_2$-based cascade cells: Annual subcontract report, 16 January 1987–15 January 1988, 14:35911 (R;US)
INDOLES
[Comparison of the activity of subsurface and surface microorganisms and their anaerobic transformation of heterocyclic compounds]: Progress report, July 1, 1987–June 30, 1989, 14:37326 (R;US)
INDUCTORS
See SOLENOIDS
INDUSTRIAL ACCIDENTS
Chemical and nuclear emergencies: Interchanging lessons learned from planning and accident experience, 14:37344 (R;US)
INDUSTRIAL MEDICINE
Quick-response evaluation of energy-related occupational safety and health programs. Task Order 1: mortality study of 50 workers exposed to coal-liquefaction processes at a Union Carbide Plant, Institute, West Virginia, 14:35541 (R;US)
INDUSTRIAL PLANTS
See also COAL GASIFICATION PLANTS
COAL LIQUEFACTION PLANTS
PETROLEUM REFINERIES
SYNTHETIC FUELS REFINERIES
WASTE PROCESSING PLANTS
Electricity - raw material, 14:36317 (RA;US)
Large industry's view of innovative pricing, 14:36319 (RA;US)
Taking charge of electricity costs, 14:36318 (RA;US)
INELASTIC SCATTERING
See also RESONANCE SCATTERING
Origin of the $^{13}C + {}^{17}O$ resonant structure, 14:37576 (R;FR)
INERTIAL SEPARATORS
Recent advances in centrifugal contactor design, 14:35822 (J;US)
INFLATIONARY UNIVERSE
Stochastic dynamics of an inflationary model and initial distribution of universes, 14:37443 (R;JP)
INFORMATION SYSTEMS
Corporate data base machines: Market analysis for the Joint Staff, 14:37820 (R;US)
Information and automation technology: Serving electric utility customers in the 1990s: Conference proceedings, 14:36257 (R;US)
Information retrieval system of nuclear fuel account for in-situ on-line control system of NPP with RBMK reactors, 14:37818 (RA;SU;In Russian)
Proceedings from the fifth information systems technology conference, 14:37823 (R;CA)
Technology 'Master List' data base management system. User's manual. Topical report, 14:35669 (R;US)
INFRARED THERMOGRAPHY
Significant improvement in IR surface-temperature measurements, 14:37137 (R;US)
INHIBITORS (CORROSION)
See CORROSION INHIBITORS
INHOMOGENEOUS PLASMA
Electron beam propagation in inhomogeneous media, 14:37747 (BA;US)
INJECTION (BEAMS)
See BEAM INJECTION
INJECTION WELLS
Reducing wellbore heat loss, 14:35623 (RA;CA)
INLAND WATERWAYS
Mitigation studies, 14:37246 (RA;NO)
INPUT WELL
See INJECTION WELLS
INSPECTOR GENERAL (US DOE)
See US DOE INSPECTOR GENERAL
INSTITUTIONAL SECTOR
User's guide to CONVEST, 14:37803 (R;US)
INSTRUMENTS (MEASURING)
See MEASURING INSTRUMENTS
INSULATING LIMITERS
See LIMITERS
INSULATING OILS
Effect of oil viscosity on transformer loading capability at ambient temperatures below 0^0C, 14:35972 (R;CA)
INSULATION (ELECTRICAL)
See ELECTRICAL INSULATION
INSULATION (THERMAL)
See THERMAL INSULATION
INSULATORS (ELECTRICAL)
See ELECTRICAL INSULATORS
INSURANCE
Insurance and bonding, 14:37401 (R;US)
INTEGRAL EQUATIONS
Canonical integration and analysis of periodic maps using nonstandard analysis and life methods, 14:37709 (R;US)
INTEGRATED CIRCUITS
Nondestructive testing for microelectronics, semiconductors, and superconductors. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:36993 (R;US)
The use of glass slides for preparing cross-section TEM samples of discrete transistors, 14:36687 (BA;US)
Tool integration and enhancement for standard cell designs, 14:37000 (R;US)
INTERCALATES
See CLATHRATES
INTERCONNECTED POWER SYSTEMS
Hydro-Quebec development plan, 1988-1990. 1997 outlook. Abridged version, 14:36224 (R;CA;In French)
Hydro-Quebec development plan, 1988-1990. 1997 outlook. Full-length version, 14:36225 (R;CA;In French)
INTERFACES
Central Potential
Pair potential approach for interfaces: fundamental problems and practical solutions, 14:37666 (BA;FR)
Chemical Reactions
Contribution of lattice matching to the interfacial energy between dissimilar materials, 14:36622 (BA;FR)
Interfacial characteristics of glass-ceramic matrix/SiC fiber composites, 14:36634 (BA;FR)
Crystal Structure
Study of long range forces in epitaxy systems: the Ag/Si interface, 14:36621 (BA;FR)
Crystal-Phase Transformations
Theory of phase transitions at internal interfaces, 14:37669 (BA;FR)
Dielectric Properties
Understanding oxide-metal interfaces, 14:36620 (BA;FR)
Diffusion
TEM study of ZrO_2/Al interface, 14:36629 (BA;FR)
Electronic Structure
Atomic structure of vitreous interfacial films in sialon, 14:36671 (BA;FR)
Grain Boundaries
Simulation study of interfaces in Ni, Al and Ni_3Al with and without boron, 14:36488 (BA;FR)
Microstructure
Bismuth segregation in Cu-Bi bicrystals, 14:36510 (BA;FR)
Chemistry and microstructure at metal-polymer interfaces, 14:36668 (BA;FR)
Grain boundaries and antiphase boundaries in GaAs, 14:36670 (BA;FR)
HVEM and HREM of interfaces in aluminum nitride ceramics, 14:36624 (BA;FR)
Hetero phase boundaries in the silver-nickel system, 14:36515 (BA;FR)
High resolution electron microscopy studies of the atomic structure of interfaces in magnetic sandwiches, 14:36494 (BA;FR)
Interfaces in composites reinforced with rapidly solidified metallic ribbons, 14:36495 (BA;FR)
Interfacial structure modifications induced by sulfur in Ag-Ni alloys, 14:36506 (BA;FR)

Phase transformation in boron doped SiC: HREM study of a twin interface, 14:36630 (BA;FR)
Structure and local electrical properties of grain boundaries in polycrystalline semiconductors, 14:36672 (BA;FR)

Potential Energy
Common factors controlling grain and phase boundary energy, 14:36517 (BA;FR)
Contribution of lattice matching to the interfacial energy between dissimilar materials, 14:36622 (BA;FR)

Thermal Stresses
Thermal strains in a bimaterial joint: Experimental and numerical analysis, 14:36586 (R;US)

INTERLABORATORY COMPARISONS
Israel EQAS for thyroid related hormones. Final report for the period June 1984 - February 1988, 14:37316 (R;XA)

INTERMEDIATE MASS NUCLEI
See also CADMIUM 110
CADMIUM 111
CADMIUM 113
COPPER 63
GERMANIUM 72
HAFNIUM 179
IODINE 131
RHODIUM 103
SELENIUM 77
STRONTIUM 90
TELLURIUM 125
ZIRCONIUM 90
Consistent systematics of nuclear level densities for mean and heavy nuclei, 14:37612 (RA;XA)

INTERMETALLIC COMPOUNDS
Controlling embrittlement at grain boundaries in intermetallic compounds, 14:37676 (BA;FR)
History of the application of the generalized Lewis acid-base theory to metals, 14:36575 (R;US)
Simulation study of interfaces in Ni, Al and Ni_3Al with and without boron, 14:36488 (BA;FR)

INTERNAL COMBUSTION ENGINES
See also DIESEL ENGINES
GAS TURBINE ENGINES
Performance and durability evaluation of a Moteurgaro engine fueled with ethanol, 14:36450 (R;ZA)

INTERNATIONAL ATOMIC ENERGY AGENCY
See IAEA

INTERNATIONAL ENERGY AGENCY
Technical and economic feasibility of central solar heating plants with seasonal storage, 14:35932 (RA;CA;In English and French)

INTERSTELLAR SPACE
Millimeter wavelength observations of SS 433 and its environs, 14:37446 (J;US)

INTRUSION DETECTION SYSTEMS
Advanced Small Site Program, 14:37789 (R;US)
Standard terminal panel and UPS [uninterruptible power supply] design for exterior intrusion detectors and data collection applications, 14:37018 (R;US)
The Outsider interruption algorithm, 14:35849 (R;US)

INVENTORIES
Appalachian States Compact Low-Level Radioactive Waste management survey, 1987, 14:35799 (R;US)

IODATES
Polymorphic transitions in $LiIO_3$ crystals, 14:36809 (RA;SU;In Russian)
Radioisotope determination of carbon impurities in cesium polyiodates, 14:36710 (RA;SU;In Russian)
Synthesis and analysis of high-pure lithium iodate monocrystals, 14:36810 (RA;SU;In Russian)

IODINE
Iodine volatility, 14:36186 (BA;US)
Sorption of radionuclides on London clay, 14:37224 (R;GB)
Technology of preparation of cesium chloride and iodine from CsI(Tl) monocrystal wastes, 14:36804 (RA;SU;In Russian)
The aqueous chemistry of iodine, 14:36856 (BA;US)

IODINE 131
Pasture grass interception and retention of ^{131}I, ^{7}Be, and insoluble microspheres deposited in rain, 14:37203 (R;US)
Proceedings of the 20th DOE/NRC nuclear air cleaning conference: Sessions 1–5, 14:37200 (R;US)

IODINE IODIDES
See IODINE

ION BEAMS
See also CARBON 12 BEAMS
DEUTERON BEAMS
FLUORINE 19 BEAMS
HYDROGEN 1 MINUS BEAMS
OXYGEN 16 BEAMS
Focused ion beam processing, 14:35853 (RA;JP;In Japanese)
Gabor lens focusing of a negative ion beam, 14:37051 (R;US)
Interaction of 20-100 MeV/u heavy ions with cold matter, 14:37573 (R;FR)
Ion beam applications in MeV region, 14:37684 (RA;JP;In Japanese)
Production of 400 MeV/u radioactive ion beams for therapy purposes, 14:37574 (R;FR)
Theoretical and numerical study of cyclotron in space charge conditions, 14:37052 (R;FR;In French)
Trends in research of ion beam application, 14:37683 (RA;JP;In Japanese)

ION EMISSION
Experiments on secondary ion emission with multicharged keV ion bombardement, 14:37471 (R;FR)

ION EXCHANGE CHROMATOGRAPHY
Novel approaches to ionic chromatography: Progress report, December 1, 1987–June 30, 1989, 14:36707 (R;US)

ION EXCHANGE MEMBRANES
See MEMBRANES

ION SOURCES
A high-intensity plasma-sputter heavy negative ion source, 14:37467 (R;US)
A lithium liquid metal ion source suitable for high voltage terminal applications, 14:37466 (R;US)
An optimized H^- magnetron ion source/lebt system, 14:37073 (R;US)
Development of the BOLVAPS [Boil-Off Lithium VAPor Source] lithium vapor source for the PBFA-II [Particle Beam Fusion Accelerator II] accelerator, 14:37775 (R;US)
Electrohydrodynamically driven, large-area liquid metal ion source for inertial confinement fusion, 14:37778 (R;US)
Ion production on the PI-110A accelerator, 14:37776 (R;US)
Ion source with peripheral magnetic field, 14:37077 (RA;SU;In Russian)
Probe measurements in the gas descharge plasma of a negative hydrogen ion source, 14:37768 (RA;SU;In Russian)
[International conference on electrostatic accelerators (ICEA), Strasbourg, France and Heidelberg, Germany, and discussion of electron cyclotron resonance ion sources, Grenoble, France, May 23–29, 1989]: Foreign trip report, 14:37091 (R;US)

ION-ATOM COLLISIONS
[Electron-ion cross beam experiments and ion-atom collisions, Louvain-la-Neuve, Belgium, Paris, France, Utrecht, the Netherlands, and Groeningen, the Netherlands, April 30–May 28, 1989]: Foreign trip report, 14:37474 (R;US)

ION-DRAG ACCELERATORS
See ELECTRON-RING ACCELERATORS

ION-ION COLLISIONS
Dynamical aspects of violent collisions in Ar + Ag reactions at E/A = 27 MeV, 14:37472 (R;FR)

ION-MOLECULE COLLISIONS
An overview of atomic and molecular processes in critical velocity ionization, 14:37750 (J;US)

IONIC CRYSTALS
Computer simulation of special grain boundaries in metals and ionic materials, 14:37692 (BA;US)

IONIC REACTIONS
See CHEMICAL REACTIONS
IONS

IONIZATION
See also PHOTOIONIZATION
An overview of atomic and molecular processes in critical velocity ionization, 14:37750 (J;US)
The effect of ultra-high vacuum on thermal ionization processes, 14:37140 (R;US)

IONIZATION CALORIMETERS
See SHOWER COUNTERS

IONIZATION CHAMBERS
Ionization chamber-detecting setup of Vasilisa installation for the study of characteristics of total fusion reaction product decay, 14:37115 (R;SU;In Russian)
Radiometric analysis of probes of environmental objects, 14:37112 (RA;SU;In Russian)

IONIZING RADIATIONS
See also COSMIC RADIATION
GAMMA RADIATION
Life-span effects of ionizing radiation in the beagle dog: A summary account of four decades of research funded by the US Department of Energy and its predecessor agencies, 14:37383 (R;US)
Mobile genetic elements, spontaneous mutations, and the assessment of genetic radiation hazards in man, 14:37342 (RA;US)

IONOPHORESIS
See ELECTROPHORESIS

IONOSONDES
Electron-density profiles and plasma-drift measurements with digital ionosondes. Technical report, July 1987-June 1988, 14:37452 (R;US)

IONOSPHERE
See also E REGION
Caviton dynamics in strong Langmuir turbulence, 14:37457 (R;US)
Electron-density profiles and plasma-drift measurements with digital ionosondes. Technical report, July 1987-June 1988, 14:37452 (R;US)
Path-integral formulation of ion heating, 14:37450 (R;US)
Theoretical modeling of plasma waves in the magnetosphere. Final report, 1 October 1982-30 September 1988, 14:37451 (R;US)

IONS
See also ANIONS
ARGON IONS
OXYGEN IONS
Electrospray ionization and collision induced dissociation of large multiply charged ions, 14:37475 (R;US)
Electrospray ionization-mass spectrometry and tandem mass spectrometry, 14:36846 (R;US)
Study of coupling in Starfish, 14:37155 (R;US)

IRAN
Statement of the Islamic Republic of Iran, 14:36453 (R;XA)

IRAQ
Statement of the official spokesman of the Iraqi Ministry of Foreign Affairs, 14:36452 (R;XA)

IRIDIUM 184
Decay of doubly-odd nucleus ^{184}Ir, 14:37594 (R;FR)

IRON
Approximation of precompound effects in Hauser-Feshbach codes for calculating double differential (n, xn) cross sections, 14:37637 (J;US)
Atomic resolution observations of solute-atom segregation and two-dimensional phase transitions at internal interfaces, 14:36512 (BA;FR)
Composition and structure of the passive oxide film on iron as observed by second harmonic generation, 14:36650 (BA;US)
Structure of Ag, Fe and Ge microclusters, 14:37477 (J;DE)

IRON 56 TARGET
Analysis of threshold reaction cross-sections and spectra of particles emitted in them on iron-group nuclei, 14:37618 (RA;XA)
Fusion-fission of heavy systems: influence of the entrance channel mass asymmetry, 14:37578 (R;FR)
Investigation of the angular distribution of secondary energy dependent inelastic neutron cross sections in structural materials using Blann's geometry dependent hybrid model, 14:37619 (RA;XA)

IRON ALLOYS
See also FERRITE
IRON BASE ALLOYS
MONEL 400
Atomic resolution observations of solute-atom segregation and two-dimensional phase transitions at internal interfaces, 14:36512 (BA;FR)
Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1, 14:35538 (R;US)
Influence of the crystallography on the incorporation of lattice dislocations in grain boundaries, 14:36507 (BA;FR)
Interfaces in composites reinforced with rapidly solidified metallic ribbons, 14:36495 (BA;FR)
Microstructural refinement of W-Ni-Fe heavy alloys by alloying additions, 14:36462 (R;US)
Migration of differently oriented grain boundaries measured on Fe-3wt%Si 37° (001) bicrystals, 14:36522 (BA;FR)
Optical properties of metals and alloys: Au, Ag, FeRh, $AuAl_2$, and $PtAl_2$, 14:36604 (D;US)

IRON BASE ALLOYS
See also KOVAR
STEELS
Sulfidation/oxidation properties of iron-based alloys containing niobium and aluminum, 14:35539 (R;US)
Theoretical analysis of phase transformations in Fe-Ni "Invar"-type alloys, 14:36580 (R;US)
[2nd international symposium on high-temperature corrosion of advanced materials and coatings, Les Embiez, France, May 22–26, 1989]: Foreign trip report, 14:35537 (R;US)
[2nd international symposium on high-temperature corrosion of advanced materials and coatings, Les Embiez, France, and visit to Manchester, England, May 19–27, 1989]: Foreign trip report, 14:35536 (R;US)

IRON BORIDES
Fundamental magnetic studies of iron-rare-earth-metalloid alloys: Technical performance report, 14:36483 (R;US)

IRON OXIDES
See also MAGNETITE
Changes in pore structure of precipitated iron oxide catalysts during pretreatment and hydrocarbon synthesis reaction, 14:36733 (RA;CA)
Health-hazard evaluation determination report No. 73-185-256, Electromotive-Division, GMC (Plant 2), Chicago, Illinois, 14:37186 (R;US)
Hetero- and homo-phase boundaries in ceramic oxides, 14:36626 (BA;FR)

IRRIGATION
Assessing the opportunity cost of fish mitigation activities in the Columbia River Basin, 14:35888 (RA;US)

ISOLATED LOCATIONS
See REMOTE AREAS

ISOTOPE PRODUCTION
Collective structures in ^{185}Hg, 14:37591 (R;FR)
Optimization of the spectrum for target irradiation, 14:36127 (RA;SU;In Russian)

ISOTOPE SHIFT
See SPECTRAL SHIFT

ISOTOPES
See also FISSION PRODUCTS
HYDROGEN ISOTOPES
PLATINUM ISOTOPES
RADIOISOTOPES
Isotopes in catalysis. Issue 147. Proceedings of the Moscow Chemical Technological Institute, 14:36702 (R;SU;In Russian)

ISOTOPIC SHIFT
See SPECTRAL SHIFT

ISRAEL
Statement of the official spokesman of the Iraqi Ministry of Foreign Affairs, 14:36452 (R;XA)

ITALY
Rospo Mare, offshore Italy. An industrial development based on horizontal wells. Technical and economical aspects, 14:35610 (RA;CA)
ITEP SYNCHROTRON
Acceleration He_4^{2+} ions on the 1-2 proton linear accelerator up to the energy of 24 MeV/nucleus, 14:37036 (RA;SU;In Russian)
ITER TOKAMAK
Role of alpha particle damping in fast wave current drive and heating, 14:37744 (R;US)

J

J PSI-3097 MESONS
Radiative decay of J/psi into $\gamma\pi^+\pi^-$, 14:37571 (R;FR)
J-3105 RESONANCES
See J PSI-3097 MESONS
JAERI
Annual report of the Osaka Laboratory for Radiation Chemistry, Japan Atomic Energy Research Institute, (no. 20). April 1, 1986 - March 31, 1987, 14:36855 (R;JP)
JAPAN
Recombinant DNA in Japan: current status and future prospects, 14:37302 (R;US)
JAPANESE ATOMIC ENERGY RESEARCH INSTITUTE
See JAERI
JET ENGINE FUELS
Jet-fuel deoxygenation. Interim report, March 1987-July 1988, 14:35642 (R;US)
Laboratory evaluation of MIL-T-83133 JP-8 fuel in army diesel engines. Interim report, October 1984-January 1988, 14:35666 (R;US)
Thermal stability of jet fuel: Second quarterly report, January–March 1989, 14:35643 (R;US)
JETS
Coal disintegration by high-pressure waterjet: Final report, 14:35514 (R;US)
JIPPT-2 DEVICE
Measurement of radiation power from the JIPP T-IIU tokamak plasma, 14:37732 (R;JP)
Plasma current startup by lower hybrid waves in the JIPP T-IIU tokamak, 14:37730 (R;JP)
JOB TRAINING
See TRAINING
JOSEPHSON JUNCTIONS
Chaos and catastrophe near the plasma frequency in the rf-biased Josephson junction, 14:36906 (J;US)
Design of variable phase velocity kinetic inductance delay lines and their measured characteristics when fabricated by a simple Nb based process, 14:36904 (J;US)
Josephson effect research in high-temperature superconductors. Interim report, 30 September 1987-29 September 1988, 14:36609 (R;US)
JT-60 REACTORS
See JT-60 TOKAMAK
JT-60 TOKAMAK
Measurement of the current distribution in JT-60 plasma by He beam, 14:37733 (R;JP;In Japanese)
JUNIPERUS
See CEDARS
JUPITER PLANET
Jovian equatorial H_2 emission from 1979-1987, 14:37427 (RA;FR)
Phenomenological analysis of Jovian north auroral H_2 Lyman band emissions, 14:37428 (RA;FR)

K

KAON NEUTRAL REACTIONS
Measurement of the decays $K_L \rightarrow 2\gamma$ and $K_S \rightarrow 2\gamma$, 14:37575 (R;FR)
KAONS
See also KAONS NEUTRAL
BNL workshop on rare K decays and CP violation, August 25-27, 1988, 14:37497 (R;US)
CP violation in K decays, 14:37533 (R;US)
KAONS NEUTRAL
$K^0_L \rightarrow \mu\mu$ polarization: Future prospects, 14:37512 (R;US)
KAPPA-725 RESONANCES
See MESONS
KETONES
See also ACETONE
ACETYLACETONE
Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, January 15, 1989–April 15, 1989, 14:35553 (R;US)
Studies on extraction of metals with 3-phenyl-4-acyl-5-isoxazolones- new series of chelating extraction (Metals: Cd, Co, Ni, etc.), 14:36835 (RA;SU)
KINETIC EQUATIONS
Explosions in Landau Vlasov dynamics, 14:37762 (R;FR)
KLYSTRONS
Amplification klystron for resonance electron accelerators, 14:37080 (RA;SU;In Russian)
Test results for experimental set of powerful pulse klystrons of RF channel of the meson factory's linear accelerator, 14:37081 (RA;SU;In Russian)
KNOCK-ON ELECTRONS
See ELECTRONS
KOBAYASHI-MASKAWA MATRIX
What do we know (and how) about the CKM [Cabibbo-Kobayashi-Maskawa] matrix, 14:37535 (R;US)
KOVAR
A method of removing oxides from the surface of Fe-Ni-Co alloy particles by chemical etching, 14:36582 (R;US)
KRYPTON 86 REACTIONS
Multiple angular scattering of heavy ions $^{16-17}O$, ^{40}Ar, ^{86}Kr, ^{100}Mo at intermediate energies (20-90 MeV/u), 14:37682 (R;FR)
KRYPTON FLUORIDE LASERS
An improved hibachi support structure for electron-beam diode foils, 14:36963 (R;US)
KrF lasers for inertial confinement fusion, 14:37770 (R;US)
Pulse-train amplification of subnanosecond near-transform-limited KrF laser pulses, 14:36972 (BA;US)
KUWAIT
Performance of first and second pilot cyclic steam stimulation projects in Kuwait, 14:35612 (RA;CA)

L

L CODES
LWR aerosol containment experiments (LACE) program and initial test results, 14:36187 (BA;US)
LAKES
See also DEAD SEA
GREAT LAKES
Determinants of Daphnia clonal diversity in lakes, 14:37277 (J;US)
Hydrologic and chemical characteristics of darkwater, clearwater and acidic lakes in the United States, 14:37267 (RA;NO)
Is the deposition of anthropogenic sulphate onto Scandinavia mature for a harrowing reconsideration ?, 14:37258 (RA;NO)
Loch Fleet Project, 14:37244 (RA;NO)
Microbial colonization on natural and artificial macrophytes in a phosphorus-limited, hardwater lake, 14:37252 (J;US)
NOGAP C-11A. Sediment regime of lakes in the Mackenzie Delta, 14:37234 (R;CA)
LAMBDA NEUTRAL
See LAMBDA PARTICLES
LAMBDA PARTICLES
See also ANTILAMBDA PARTICLES
Lambda-antilambda decay asymmetries and CP violation, 14:37504 (R;US)

LAMINAR FLOW
Finite control volume modeling of laminar and turbulent flow of air in an enclosure, 14:37485 (R;US)
LAMPF LINAC
Cost projection for a superconducting linac structure, 14:37042 (R;US)
Summary of Linac Group discussions, 14:37043 (R;US)
LAND APPLICATION
See GROUND DISPOSAL
LAND FILLS
See SANITARY LANDFILLS
LAND POLLUTION
Oil at shore and in deposits. Succesive report 1987, 14:35662 (R;NO;In Norwegian)
Review of environmental monitoring equipment for air water and soil systems. Vol. 2-Environmental monitoring equipment database, 14:35966 (R;CA)
Review of environmental monitoring equipment for air, water and soil systems. Vol. 1 - Instrument review, 14:35967 (R;CA)
Review of environmental monitoring equipment for air, water and soil systems. Vol 2(ii)-Equipment data sheets. Record #247-528, 14:35965 (R;CA)
Review of environmental monitoring equipment for air, water and soil systems. Vol. 2(iii)-Equipment data sheets. Record #529-586, user and utility information records, 14:35964 (R;CA)
Use of industrial-hygiene samplers for soil-gas measurement, 14:37221 (R;US)
LAND RESOURCES
Perspectives on land modelling. Workshop proceedings, 14:36235 (R;CA)
LANDFILLS
See SANITARY LANDFILLS
LANGMUIR OSCILLATIONS
See PLASMA WAVES
LANTHANIDES
See RARE EARTHS
LANTHANUM
Theoretical investigations of phonon anomalies in fcc La and W(001), 14:36603 (D;US)
LANTHANUM ALLOYS
Catalytic properties of hydride-forming intermetallic compounds in reactions with the participation of hydrogen, 14:36814 (RA;SU;In Russian)
LANTHANUM CHROMITES
See CHROMIUM OXIDES
LANTHANUM OXIDES
LANTHANUM ISOTOPES
Decay of new mass-separated neutron-deficient La and Ce isotopes, 14:37581 (R;FR)
LANTHANUM OXIDES
X-ray absorption spectroscopy investigations of high Tc superconductors, 14:36649 (BA;US)
LANTHANUM PHOSPHATES
On the compounds of rubidium, cesium and lanthanum polyphosphates, 14:36748 (RA;SU;In Russian)
LASER MATERIALS
Chiral organic crystals for high power frequency conversion, 14:37781 (R;US)
Fracture mechanisms and strengthening of slab lasers, 14:36683 (BA;US)
Laser action in chromium-activated forsterite for near-infrared excitation, 14:36959 (R;US)
Laser materials: radiation damage. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:37400 (R;US)
Thermal fracture in selected nonlinear optical materials, 14:36682 (BA;US)
LASER RADIATION
Laser materials: radiation damage. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:37400 (R;US)
Linear theory of uncompensated thermal blooming in turbulence, 14:37486 (R;US)
LASER WELDING
Calibration of beam power monitors for laser welding, 14:36970 (BA;US)
Mechanisms that control the geometry of pulsed Nd:YAG laser welds, 14:36583 (R;US)
LASER-PRODUCED PLASMA
Effect of electron distribution function inhomogeneity on heat transfer in a laser-produced plasma, 14:37727 (RA;SU;In Russian)
High intensity laser-matter interactions, 14:37745 (B;US)
Spectroscopy of absorbers in rare gas-halide laser plasmas, 14:36968 (BA;US)
X-ray absorption spectroscopy of laser-produced plasmas: A study of the experiment and data analysis, 14:37752 (J;US)
XUV laser amplification in recombining laser-produced plasmas, 14:37489 (D;GB)
LASERS
See also FREE ELECTRON LASERS
GAS LASERS
SOLID STATE LASERS
X-RAY LASERS
Calibration of beam power monitors for laser welding, 14:36970 (BA;US)
Stability of laser beams in a structured environment, 14:36975 (BA;US)
LASL
LAVA [Los Alamos Vulnerability and Risk Assessment] and classical risk analysis, 14:35838 (R;US)
LATTICE FIELD THEORY
Machines for lattice gauge theory, 14:37549 (R;US)
LAWRENCE LIVERMORE LABORATORY
Energy and Technology Review, 14:37303 (R;US)
LEACHATES
Drum centrifuge modelling of long-term pollutant migration through a soil layer, 14:37222 (R;GB)
Leaching characteristics of incinerator residues and potential for modification of leaching, 14:36431 (R;NL)
LEAD
A test system for thermomechanical fatigue of solder joints, 14:36585 (R;US)
Electrochemically adsorbed Pb on Ag (111) studied with grazing- incidence x-ray scattering, 14:36854 (R;US)
Ion exchange and soil attenuation of Gulf Coast and Great Plains soils: Final report, 14:37217 (R;US)
Lead pollution: public health hazards and environmental toxicity. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:37332 (R;US)
Lead: occupational health hazards. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:37331 (R;US)
National Performance Audit Program; ambient air audits of analytical proficiency, 1987, 14:37189 (R;US)
New ideas on interface structure from significant disagreements between experiments and prediction of interface composition in Ag base alloys, 14:36505 (BA;FR)
Observations on the mechanisms of fatigue in eutectic Pb-Sn solder joints, 14:36574 (R;US)
The analysis of lead slump effects in shipping casks for radioactive materials, 14:36894 (R;US)
LEAD 207 TARGET
Study on total disintegration of lead nuclei with magnesium-24 nuclei at 4.5 A GeV/c, 14:37598 (R;SU;In Russian)
LEAD ALLOYS
Cyclic migration and fracture in solid solution alloys, 14:36988 (BA;FR)
Permittivity relaxation in $Pb_{1-x}Ge_xTe$, 14:36558 (RA;SU;In Russian)
Structural and thermodynamic evidence for the survival of Zintl ions through the melting process: The alkali-lead alloys, 14:36662 (R;US)
LEAD OXIDES
Mass spectrometry for investigations into the system lead/oxygen, using the electrochemical Knudsen cell, 14:36743 (R;DE;In German)

LEAD SULFIDES
Scanning tunneling microscopy of an ion-bombarded PbS(001) surface, 14:36656 (R;US)
LEAD-ACID BATTERIES
Accelerated life evaluation of valve-regulated lead-acid batteries, 14:36221 (R;US)
LEAVES
Effects of air pollutants on the composition of stable carbon isotopes $\delta^{13}C$, of leaves and wood, and on leaf injury, 14:37396 (J;US)
Physiological aspects of deposition of trace gases to leaves, 14:37397 (J;US)
LEP STORAGE RINGS
A superconducting iron-dominated quadrupole for CEBAF, 14:36939 (J;US)
LEPTON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET
LEPTONS
See also ELECTRONS
HEAVY LEPTONS
NEUTRINOS
Probing nuclear currents with dilepton production in ultrarelativistic heavy-ion collisions, 14:37498 (R;US)
The search for charged-lepton specific forces and the PEGASYS facility, 14:37531 (R;US)
LEUKEMIA VIRUSES
Regulation of expression and transposition of murine endogenous retroviral elements, 14:37292 (RA;US)
LEVITATED TRAINS
Super high-speed magnetically levitated system approaches: practical use, 14:36404 (R;JP)
The US market for high-speed maglev vehicles, 14:36401 (R;US)
LICENSE APPLICATIONS
Cask drop testing and analysis, 14:36869 (R;US)
LIE GROUPS
See also CONFORMAL GROUPS
GRADED LIE GROUPS
SU GROUPS
Minuscule weights and Kronecker products, 14:37701 (RA;RO;In Romanian)
LIE SUPERALGEBRA
See GRADED LIE GROUPS
LIFETIME
Implementation of computer programmes for fitting of positron annihilation spectra on "personal computers". Final report for the period 1 May 1986 - 14 June 1988, 14:37468 (R;XA)
LIGHT
See VISIBLE RADIATION
LIGHT GUIDES
See OPTICAL FIBERS
LIGHT WATER COOLED REACTORS
See WATER COOLED REACTORS
LIGHTING SYSTEMS
Evaluation of commercially available lighting design software, 14:36397 (R;US)
LIGNITE
Microbial coal liquefaction, 14:35520 (R;US)
LIMESTONE
Modelling of sulphur dioxide capture in fluidized bed combustion, 14:35594 (R;SE)
LIMING
Liming as a method to neutralize highly acidic drainage waters from sulphate basins in western Finland, 14:37247 (RA;NO)
LIMITERS
External ion beam analysis of the TFTR [Tokamak Fusion Test Reactor] bumper limiters, 14:37777 (R;US)
LINACS
See LINEAR ACCELERATORS
LINEAR ACCELERATORS
See also ATLAS SUPERCONDUCTING LINAC
CEBAF ACCELERATOR
LAMPF LINAC
LINEAR COLLIDERS
STANFORD LINEAR COLLIDER
1 MeV proton accelerator, 14:37038 (RA;SU;In Russian)
BUCKSHOT simulations of beam injection on the recirculating linac, 14:37093 (R;US)
Compact linacs for positron emission tomography, 14:37035 (R;US)
Cost of a normalconducting linac structure, 14:37041 (R;US)
Novel methods of acceleration. Final report, 30 September 1983-29 September 1988, 14:37067 (R;US)
On the possibility of construction of the parallel-coupled structure for the small-energy electron linear accelerator, 14:37082 (RA;SU;In Russian)
Proton linear accelerators: A theoretical and historical introduction, 14:37040 (R;US)
Reconstruction project for accelerating structure of small-size deuteron linear accelerator, 14:37037 (RA;SU;In Russian)
LINEAR COLLIDERS
General properties of an asymmetric B-factory lattice, 14:37064 (R;US)
LINEAR Z PINCH DEVICES
Radiative collapse of a Bennett-relaxed z-pinch, 14:37736 (R;US)
The high density z-pinch II experiment, 14:37735 (R;US)
The stability of the High-Density Z-Pinch, 14:37737 (R;US)
Two-dimensional effects in hollow core Z-pinches, 14:37743 (R;US)
LIQUID ASPHALT
See PETROLEUM RESIDUES
LIQUID COLUMN CHROMATOGRAPHY
Column efficiency determination, 14:36730 (BA;US)
Study of the separation of two overlapping compounds in preparative liquid chromatography, 14:36852 (BA;US)
LIQUID EFFLUENTS
See LIQUID WASTES
LIQUID FUELS
See also FUEL OILS
GASOLINE
Coal/oil coprocessing mechanism studies, 14:35546 (J;US)
Liquid fuels from the pyrolysis of municipal solid waste and its components, 14:36442 (BA;US)
LIQUID SCINTILLATION DETECTORS
Thermal neutron detection with a lithium-6 loaded liquid scintillator, 14:37114 (R;FR)
LIQUID SCINTILLATORS
Development of new scintillating fiber detectors for high energy physics applications, 14:37109 (R;US)
LIQUID WASTES
See also WASTE WATER
Separation potential of solvent extraction in the recovery of metals, 14:35762 (BA;US)
Solidification of low-level radioactive waste at the Savannah River Site, 14:35818 (R;US)
LIQUIDS
See also COAL LIQUIDS
NATURAL GAS LIQUIDS
The physics of pattern formation at liquid interface: Progress report, June 1, 1988–May 31, 1989, 14:37664 (R;US)
LITHIUM
Introduction to lithium batteries. General document, 14:36220 (R;AU)
LITHIUM 7 TARGET
$^{7}Li(p,n)^{7}Be$ and $^{12}C(p,n)^{12}N$ reactions at 200, 300, and 400 MeV, 14:37579 (J;US)
LITHIUM ALLOYS
Vapor pressure over corrosion resistant alkali metal alloys, 14:36552 (RA;SU;In Russian)
LITHIUM CARBIDES
Staging in layer intercalates: Progress report, 1 June 1988–31 May 1989, 14:36667 (R;US)
LITHIUM CHLORIDES
Analysis of a thermochemical energy storage system with liquid absorbents, 14:36217 (RA;CA;In English and French)
Complexing in ternary chloride systems of alkali metals and lead, 14:36792 (RA;SU;In Russian)

LITHIUM COMPLEXES
Compton profile of graphite and lithium-intercalated graphite, 14:36684 (BA;US)

LITHIUM COMPOUNDS
See also LITHIUM CARBIDES
LITHIUM OXIDES
LITHIUM SILICATES
LITHIUM SULFIDES
LITHIUM TUNGSTATES
Investigations into physicochemical properties of lithium metaaluminate ceramics, 14:36636 (RA;SU;In Russian)
Polymorphic transitions in $LiIO_3$ crystals, 14:36809 (RA;SU;In Russian)
Prospects of ceramic tritium breeder materials, 14:37754 (R;FR)
Synthesis and analysis of high-pure lithium iodate monocrystals, 14:36810 (RA;SU;In Russian)
Synthesis and properties of $LiAlO_2$ lithium aluminate monocrystals, 14:36637 (RA;SU;In Russian)

LITHIUM FLUORIDES
Common factors controlling grain and phase boundary energy, 14:36517 (BA;FR)
Contribution of lattice matching to the interfacial energy between dissimilar materials, 14:36622 (BA;FR)

LITHIUM OXIDES
Lithium beryllates and their thermodynamic properties, 14:36790 (RA;SU;In Russian)

LITHIUM SILICATES
Interfacial characteristics of glass-ceramic matrix/SiC fiber composites, 14:36634 (BA;FR)

LITHIUM SULFIDES
Staging in layer intercalates: Progress report, 1 June 1988–31 May 1989, 14:36667 (R;US)

LITHIUM TUNGSTATES
Interaction of thallium (1) and lithium molybdates (tungstates), 14:36766 (RA;SU;In Russian)
Physicochemical features of Li_2MoO_4 and Li_2WO_4 behaviour under different methods of treatment, 14:36769 (RA;SU;In Russian)

LIVER
Experimental model of radiation injuries of liver, 14:37359 (RA;SU;In Russian)
Possible role of retrotransposons in carcinogenesis, 14:37389 (RA;US)

LMFBR TYPE REACTORS
Overview of the US program of controls for advanced reactors, 14:36027 (R;US)
Submerged gravel scrubber demonstration as a passive air cleaner for containment venting and purging with sodium aerosols—CSTF tests AC7–AC10, 14:36028 (R;US)
Supervisory control in a distributed, hierarchical architecture for a multimodular LMR, 14:36094 (R;US)

LOCA
See LOSS OF COOLANT

LOCAL GOVERNMENT
Municipal technologies: An assessment of energy technologies for the City of Chicago, 14:36426 (R;US)

LOCKS (SECURITY)
See PHYSICAL PROTECTION DEVICES

LOCOMOTIVES
Software development for a microprocessor based controller for ac-dc-ac diesel-electric freight locomotive power unit control, 14:36443 (R;CA)

LONG ISLAND SOUND
Marine biomass: New York State species and site studies. Annual report December 1982-November 1983, 14:35906 (R;US)

LONGITUDINAL PINCH DEVICES (LINEAR)
See LINEAR Z PINCH DEVICES

LONGWALL MINING
Improvement of work safety and strain reduction when equipping thin faces through the development and testing of a turning and swinging installation for shield support units. Final report, 14:35596 (R;DE;In German)

LOS ALAMOS
A computer model of the ZTH energy system at Los Alamos, 14:37749 (J;US)

LOS ALAMOS MESON PHYSICS FACILITY
See LAMPF LINAC

LOS ALAMOS SCIENTIFIC LABORATORY
See LASL

LOSS OF COOLANT
ATHLET - an advanced system code for the analysis of thermohydraulic processes, 14:36152 (R;DE;In German)
Break location effects on PWR small break LOCA phenomena. Inadequate core cooling in lower plenum break test at LSTF, 14:36156 (R;JP)
Interfacing systems LOCAs at boiling water reactors, 14:36178 (BA;DE)
Use of source term code package in the ELEBRA MX-850 system, 14:36132 (R;BR;In Portuguese)

LOW ALLOY STEELS
New generation of welded semiautomatic for production of structures out of steels and aluminium alloys, 14:36566 (RA;SU;In Russian)

LOW DOSE IRRADIATION
New aspects in studying the effect of low dose ionizing radiations, 14:37370 (RA;SU;In Russian)

LOW-LEVEL RADIOACTIVE WASTES
1988 DOE model conference proceedings: Volume 1, 14:35771 (R;US)
1988 DOE model conference proceedings: Volume 2, 14:35772 (R;US)
1988 DOE model conference proceedings: Volume 3, 14:35773 (R;US)
1988 DOE model conference proceedings: Volume 4, 14:35774 (R;US)
A study of the use of crosslinked high-density polyethylene for low-level radioactive waste containers, 14:35794 (R;US)
Appalachian States Compact Low-Level Radioactive Waste management survey, 1987, 14:35799 (R;US)
Assessment of potential worker exposure for the Tumulus Disposal Demonstration Project: Fiscal year 1988 annual report, 14:35798 (R;US)
Below Regulatory Concern Owners Group: Assessment of the IMPACTS-BRC code: Final report, 14:35786 (R;US)
Below regulatory concern owners group: A general review of the IMPACTS-BRC Code: Final Report, 14:35785 (R;US)
Solidification of low-level radioactive waste at the Savannah River Site, 14:35818 (R;US)
Technology assessment guide for application of engineered sorbent barriers to low-level radioactive waste disposal sites, 14:35802 (R;US)
Treatment needs for Greater-Than-Class C low-level waste, 14:35804 (R;US)

LUCIE-1 REACTOR
SRO supervisory skills, 14:36005 (RA;US)

LUCIE-2 REACTOR
SRO supervisory skills, 14:36005 (RA;US)

LURGI-RUHRGAS PROCESS
Coking of oil sand, asphaltenes and residual oils in the LR-process, 14:35705 (RA;CA)

LWGR TYPE REACTORS
See also CHERNOBYLSK-4 REACTOR
Calculational method for individual pipeline tracing in channel nuclear reactors, 14:36018 (RA;SU;In Russian)
Transients in boiling water cooled channel reactors under loss of control at low power levels, 14:36016 (RA;SU;In Russian)

LWR TYPE REACTORS
See WATER COOLED REACTORS

LYMPHOCYTES
Biological effects of ^{137}Cs, incorporated into organism of rats, 14:37367 (RA;SU;In Russian)
HTLV-I, HIV, and human T cell growth, 14:37329 (RA;US)

LYMPHOID CELLS
See LYMPHOCYTES

LYMPHOKINES
HTLV-I, HIV, and human T cell growth, 14:37329 (RA;US)

M

M CODES
A sensitivity of aerosol agglomeration and deposition using the MAEROS model, 14:36188 (BA;US)

MA 754
See NICKEL BASE ALLOYS

MA 956
See IRON BASE ALLOYS

MACHINE PARTS
A review of the development of a program to generate inspection programs for the OGP [Optical Gaging Products] optical CMM [Coordinate Measuring Machine], 14:37147 (R;US)

MACHINE TOOLS
See also GRINDING MACHINES
A proposal of more expedient methods of testing machine tools, 14:36998 (R;US)
PFMS [Precision Flexible Manufacturing System] tool characterization study at Lawrence Livermore National Laboratory, 14:36587 (R;US)

MADAGASCAR
Positive effects of the bemolanga tar sands exploitation, 14:35737 (RA;CA)

MAGMA SYSTEMS
Research drilling in young silicic volcanoes, 14:37413 (R;US)

MAGNESIUM
Measurements of the elastic constants, the specific heat and the entropy of grain boundaries by means of ultra-fine grained materials, 14:36541 (BA;FR)

MAGNESIUM 24 TARGET
Isovector and isoscalar spin-flip excitations in even-even s-d shell nuclei excited by inelastic proton scattering, 14:37630 (R;FR)

MAGNESIUM 26 TARGET
Isovector and isoscalar spin-flip excitations in even-even s-d shell nuclei excited by inelastic proton scattering, 14:37630 (R;FR)

MAGNESIUM ALLOYS
Cyclic migration and fracture in solid solution alloys, 14:36988 (BA;FR)
Hydrogen embrittlement in grain boundaries studied by fatigue crack propagation in Al-Zn-Mg bicrystals, 14:36987 (BA;FR)
Star-disclination in a ferro-elastic material B19 MgCd alloy, 14:36543 (BA;FR)
Star-lisclination in a ferro-elastic material B19 MgCd alloy, 14:36491 (BA;FR)

MAGNESIUM OXIDES
Contribution of lattice matching to the interfacial energy between dissimilar materials, 14:36622 (BA;FR)
Effect of thermal aging on mechanical and electrical properties of the MgO-partially stabilized zirconia bodies, 14:36526 (BA;FR)
Electron microscopy studies of diffusion-induced grain boundary migration in ceramics, 14:36535 (BA;FR)
Equilibrium crystal shapes and surface phase diagrams at surfaces in ceramics, 14:36631 (BA;FR)
Hetero- and homo-phase boundaries in ceramic oxides, 14:36626 (BA;FR)
Influence of doping elements on the grain boundary characteristics in alumina, 14:36632 (BA;FR)
Neutron transmission of single crystal MgO filters, 14:37097 (J;NL)
Phase equilibria and interfacial phenomena in the Mg-Al-O system at 800°C, 14:36500 (BA;FR)
Structure of Ni/MgO interfaces, 14:36489 (BA;FR)

MAGNESIUM PHOSPHATES
Determination of specific heats of double magnesium and alkali metal orthophosphates (Alkali metals: Li-Cs.), 14:36753 (RA;SU;In Russian)
On the kinetics of dehydration of double orthophosphate hexahydrates $MgMPO_4$, 14:36749 (RA;SU;In Russian)

MAGNESIUM SILICATES
Laser action in chromium-activated forsterite for near-infrared excitation, 14:36959 (R;US)

MAGNESIUM SULFATES
Coal ash deposition, interaction with metal substrates and deposit build up: Summary report, 26 February 1989–25 May 1989, 14:35586 (R;US)

MAGNET COILS
A comparison of the conductor requirements for energy storage devices made with ideal coil geometries, 14:36928 (J;US)

MAGNETIC COILS
See MAGNET COILS

MAGNETIC COMPRESSION
A simultaneous helical generator, 14:37011 (R;US)
Applications of the computer codes FLUX2D and PHI3D for the electromagnetic analysis of compressed magnetic field generators and power flow channels, 14:37480 (R;US)
Design of an explosive pulsed power system for driving 16-MA plasma flow switch experiments, 14:37734 (R;US)
Explosively formed fuse opening switches for use in flux-compression generator circuits, 14:37007 (R;US)

MAGNETIC FIELDS
Determination of magnetic field direction in tokamaks from laser-induced Lyman-α fluorescence, 14:37717 (R;FR)
Magnetic field decay in model SSC dipoles, 14:36913 (J;US)
Standard-II and extended tests of the Swiss LCT-coil, 14:36915 (J;US)
Studies of time dependence of fields in Tevatron superconducting dipole magnets, 14:36921 (J;US)
Study of weak solar magnetic fields. Final report, 1 December 1987-30 November 1988, 14:37424 (R;US)
Time variations of fields in superconducting magnets and their effects on accelerators, 14:36920 (J;US)

MAGNETIC LEVITATED TRAINS
See LEVITATED TRAINS

MAGNETIC MATERIALS
Cross-sectioning magnetic thin films for TEM, 14:36685 (BA;US)

MAGNETIC STORMS
Global density specification in the lower thermosphere. Final report, 15 June 1985-17 June 1988, 14:37448 (R;US)

MAGNETITE
Stemming temperature changes during emplacement: Experimental results and analysis, 14:36982 (R;US)

MAGNETIZATION
Anomalous temperature dependence of Cu NMR line width and magnetization in $YBa_2Cu_3O_{7-\delta}$, 14:36642 (R;US)

MAGNETOHYDRODYNAMIC CHANNELS
See MHD CHANNELS

MAGNETOHYDRODYNAMIC GENERATORS
See MHD GENERATORS

MAGNETOPAUSE
Magnetopause structure and dynamics: Issues for GEM [geospace environment modeling], 14:37456 (R;US)

MAGNETOSPHERE
See EARTH MAGNETOSPHERE

MAGNETOTAIL
Parallel electric fields in a simulation of magnetotail reconnection and plasmoid evolution, 14:37455 (R;US)

MAHOGANY TREES
See TREES

MAINTENANCE FACILITIES
Radiological survey of San Diego Bay, 14:37279 (R;US)

MAIZE
DNA modification of Mu elements in maize, 14:37313 (RA;US)
Regulation of the maize suppressor-mutator element, 14:37287 (RA;US)

MALIGNANCIES
See NEOPLASMS

MAMMARY GLANDS
Some questions of blastomogenic effect of internal irradiation on mammary gland, 14:37366 (RA;SU;In Russian)

MAN
Mobile genetic elements, spontaneous mutations, and the assessment of genetic radiation hazards in man, 14:37342 (RA;US)

MANATEES
Preliminary assessment of habitat protection needs for West Indian manatees on the east coast of Florida and Georgia. Final report, 14:37284 (R;US)

MANGANESE
Effect of manganese on intergranular fracture in low alloy steels, 14:36537 (BA;FR)

MANGANESE ALLOYS
See also MONEL 400
Development of an engineering definition of the extent of J singularity controlled crack growth, 14:36579 (R;US)
On the properties of new corrosion-resistant high-strength steel 06Kh17G19N3AB and it welded joints, 14:36567 (RA;SU;In Russian)
Studies on work-softening processes in the hot forming of austenitic steel, 14:36581 (TJ;US)

MANGANESE COMPOUNDS
See also MANGANESE OXIDES
Systems MVO_3-$Zn(VO_3)_2$ and MVO_3-$Mn(VO_3)_2$, where M=Li, Rb, Cs, 14:36770 (RA;SU;In Russian)

MANGANESE OXIDES
Hetero- and homo-phase boundaries in ceramic oxides, 14:36626 (BA;FR)

MANITOBA
Application by Greater Winnipeg Gas Company and ICG Utilities (Manitoba) Ltd. for an order or orders approving rates for the sale of natural gas from November 1, 1988 to October 31, 1990, flowing from new gas supply contracts, 14:35677 (R;CA)
Final report of the Commission of Inquiry into Gasoline Pricing in the province of Manitoba, 1987, 14:35655 (R;CA)
Manitoba Hydro application for an order requesting a general rate review and approval of certain rate adjustments effective April 1, 1989, 14:36339 (R;CA)
Summary of phytoplankton data for the Nelson River and Rat-Burntwood lakes, 1987, 14:37235 (R;CA)
Water chemistry/water discharge relationships within the Churchill River diversion and Lake Winnipeg regulation region, Manitoba, Canada, 14:35895 (R;CA)

MANUFACTURERS
Assessment of unitary cool storage systems: Final report, 14:36413 (R;US)

MANUFACTURING FACILITIES
See INDUSTRIAL PLANTS

MANY-BODY PROBLEM
See also THREE-BODY PROBLEM
Quantum random processes and kinetic equations of multi-quantum systems, 14:37704 (RA;SU)

MARINE DISPOSAL
Beaufort Sea ocean dumpsite characterization, 14:35657 (R;CA)
Ocean waste disposal: outfall sewers. January 1977-April 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-April 1989, 14:36441 (R;US)
Recommendations on a preferred site for the ocean disposal of bulky inert materials in Beaufort Sea waters adjacent to the Northwest Territories, 14:35658 (R;CA)
Selection of an area in the Canadian Beaufort Sea for disposal of inert bulky materials such as scrap metal. An assessment of options, 14:35659 (R;CA)

MARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS

MARINE INSURANCE
See INSURANCE

MARITIME TRANSPORT
Transportation rate services, 14:36410 (R;US)

MARKETING
Transferring technology. A social marketing perspective, 14:36230 (RA;CA)

MASS BALANCE
Modeling hydrogen water chemistry for BWR applications: Final report, 14:35991 (R;US)

MASS SPECTROMETERS
Explosives detection with an ion trap mass spectrometer, 14:37148 (R;US)
The on-line combination of capillary isotachophoresis with mass spectrometry, 14:37142 (R;US)

MASS SPECTROSCOPY
Detection of photon bursts from single 200 eV Mg ions: Progress in photon burst mass spectrometry, 14:37139 (R;US)
Speculation on the mechanism(s) of electrospray ionization, 14:37143 (R;US)

MASS TRANSIT SYSTEMS
History of the negotiations of the Washington Metropolitan Area Transit Authority, 14:36408 (R;US)
Planning techniques for intercity transportation services. Final report, 14:36407 (R;US)

MASSACHUSETTS
Fiscal year 1987 program report (Massachusetts Water Resources Research Center). Annual report, 14:37280 (R;US)

MATERIALS
See also BUILDING MATERIALS
CARBONACEOUS MATERIALS
COMPOSITE MATERIALS
HAZARDOUS MATERIALS
LASER MATERIALS
MAGNETIC MATERIALS
MATRIX MATERIALS
RADIOACTIVE MATERIALS
REACTOR MATERIALS
REINFORCED MATERIALS
SEALING MATERIALS
SEMICONDUCTOR MATERIALS
SHIELDING MATERIALS
STEMMING MATERIALS
THERMONUCLEAR REACTOR MATERIALS
TOXIC MATERIALS
A comparison of fatigue crack propagation in Modes I and III, 14:36701 (BA;US)
Channelling and related effects in electron microscopy: The current status, 14:36726 (R;US)
Chemistry and Materials Science research report: Weapons-Supporting Research and Departmental Institutional Research and Development: First half FY1989, 14:37158 (R;US)
Precracking and computerized single-specimen J_{Ic} determination for irradiated three-point bend specimens, 14:36172 (BA;US)
Proceedings of the 3rd Berkeley conference on corrosion-erosion-wear of materials at elevated temperatures, 14:36589 (B;US)

MATERIALS (BUILDING)
See BUILDING MATERIALS

MATERIALS (COMPOSITE)
See COMPOSITE MATERIALS

MATERIALS (MAGNETIC)
See MAGNETIC MATERIALS

MATERIALS (REINFORCED)
See REINFORCED MATERIALS

MATERIALS (SEMICONDUCTOR)
See SEMICONDUCTOR MATERIALS

MATERIALS (SHIELDING)
See SHIELDING MATERIALS

MATHEMATICAL MODELS
See also COSMOLOGICAL MODELS
CRYSTAL MODELS
1988 DOE model conference proceedings: Volume 1, 14:35771 (R;US)

MATRIX MATERIALS
Properties of the new high T_c materials, 14:36654 (J;US)
Superconductivity, critical current density, and magnetic properties of Fe-substituted $Y_1Ba_2(Cu_{1-x}Fe_x)_3O_z$ materials, 14:36949 (J;US)

MC GUIRE-1 REACTOR
Annual critique: an effective program evaluation tool, 14:36139 (RA;US)

MC GUIRE-2 REACTOR
Annual critique: an effective program evaluation tool, 14:36139 (RA;US)

MEAN LIFE
See LIFETIME

MEAN-FIELD THEORY
Transition between phenomena governed by the mean field and those governed by nucleon-nucleon collisions in the reaction $^{40}Ar + {}^{68}Zn$, 14:37580 (R;FR;In French)

MEASURING INSTRUMENTS
See also CALORIMETERS
DOSEMETERS
RADIATION DETECTORS
SPECTROMETERS
STRAIN GAGES
VISCOSIMETERS
Description of the Nano∆Indenter™; An ultra-low-load microhardness indentation test machine, 14:36996 (R;US)
Droplet sizing calibration of the Phase Doppler Particle Analyzer, 14:37145 (R;US)
Electron-density profiles and plasma-drift measurements with digital ionosondes. Technical report, July 1987-June 1988, 14:37452 (R;US)
HEU [highly enriched uranium] drum monitor manual (for confirmatory measurements), 14:35768 (R;US)
High-temperature optical-fiber pH sensor: Final report, 14:36848 (R;US)
Structural integrity evaluation based on an innovative field indentation microprobe, 14:36984 (R;US)
Study of fine-scale solar dynamics. Final report, 6 September 1985-31 October 1988, 14:37423 (R;US)
The PVF2 piezoelectric polymer shock stress sensor: System characterization for application under field test conditions, 14:36891 (R;US)
Waste Isolation Pilot Plant brine field pH measurements: Technique and interpretation, 14:35810 (R;US)

MECHANICAL STRUCTURES
See also SUPPORTS
DYNA3D user's manual: (Nonlinear dynamic analysis of structures in three dimensions): Revision 5, 14:36893 (R;US)

MEDICAL EXAMINATIONS
Number of roentgenological procedures per one X-ray examination as quality index roentgenodiagnosis, 14:37656 (RA;SU;In Russian)

MEDICAL PERSONNEL
See also RADIOLOGICAL PERSONNEL
Doses of occupational irradiation of medical personnel of the RSFSR, 14:37653 (RA;SU;In Russian)
Radiation hygienic characteristic of working conditions and health of women operating in X-ray diagnostic departments, 14:37654 (RA;SU;In Russian)

MEDICAL SURVEILLANCE
On improved medical surveillance of personnel operating with radiation sources, 14:37652 (RA;SU;In Russian)

MEETINGS
Proceedings of the 20th DOE/NRC nuclear air cleaning conference: An index to the 1st–20th AEC/ERDA/DOE and DOE/NRC nuclear air cleaning conferences, 14:37202 (R;US)

MELANOCYTES
See ANIMAL CELLS

MELTDOWN
Analysis of the CSNI/GREST core concrete interaction chemical thermodynamic benchmark exercise using the MPEC2 computer code, 14:35993 (R;JP)

MEMBRANES
See also MUCOUS MEMBRANES
Development of a membrane SO_x/NO_x treatment system: Final report, 28 April 1987–28 April 1988, 14:35957 (R;US)

MEMORY DEVICES
Reliability estimates for large satellite memories in low earth orbits, 14:37002 (R;US)

MENDELEEV PERIODIC SYSTEM
See PERIODIC SYSTEM

MERCURY
Canada-Manitoba agreement on the study and monitoring of mercury pollution in the diversion system of the Churchill River. Summary report, 14:35896 (R;CA;In French)
Coherent VUV source at 130 nm, 14:36974 (BA;US)

MERCURY 185
Collective structures in ^{185}Hg, 14:37591 (R;FR)

MERCURY BROMIDES
Solubility of solid phases of the system $CsBr-HgBr_2-H_2O$ at 50 and 75 deg C, 14:36793 (RA;SU;In Russian)

MESH GENERATION
Using conjoint meshing primitives to generate quadrilateral and hexahedral elements in irregular regions, 14:37810 (R;US)

MESON RESONANCES
See MESONS

MESON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET

MESON-NUCLEON INTERACTIONS
See also PION-NUCLEON INTERACTIONS
Physics with ETA mesons, 14:37510 (R;US)

MESONS
See also CHARMED MESONS
Medium energy meson physics: Progress report, January 1, 1986 through December 31, 1986, 14:37565 (R;US)
[Medium energy meson research]: [Progress report], 14:37570 (R;US)

MESSENGER-RNA
Induction of VL30 element expression as a response to anoxic stress, 14:37388 (RA;US)

METAGALAXY
See UNIVERSE

METAL INDUSTRY
Combustion research opportunities for industrial applications: Phase II, 14:36412 (R;US)
Gas-based iron making: feasibility study. Final report, April 1985-December 1986, 14:36419 (R;US)
Health-hazard evaluation determination report No. 74-78-297, Amax Speciality Metals, Parkersburg, West Virginia, 14:37185 (R;US)
Health-hazard evaluation determination report No. 75-109, 110, 112, 114-274, Fairbanks Weighing Division, Colt Industries, St. Johnsbury, Vermont, 14:37182 (R;US)

METALLIC GLASSES
The nature and composition of the passive film formed on Ni-P-Cr metallic glasses, 14:36366 (BA;US)

METALLOPROTEINS
See also FERRITIN
Detection and characterization of novel metal-binding proteins: Final report, 14:37324 (R;US)

METALS
See also ACTINIDES
ALKALI METALS
ALUMINIUM
ANTIMONY
BISMUTH
CADMIUM
GALLIUM
GERMANIUM
INDIUM
LEAD
MERCURY
RARE EARTHS
TIN
ZINC
Atomic level observation of grain boundaries in metals, 14:36484 (BA;FR)
Computer simulation of special grain boundaries in metals and ionic materials, 14:37692 (BA;US)
Interface crack models, 14:37675 (BA;FR)
Ion-beam studies of hydrogen-metal interactions, 14:36606 (J;NL)
Preparation of thin-foil TEM specimens from sub-millimeter particulate, 14:36600 (BA;US)
Resonant charge-exchange studies with hyperthermal-energy ion beams: development of multi-detection capabilities and a data acquisition system. Final report, 15 November 1986-14 May 1988, 14:37460 (R;US)
Structural integrity evaluation based on an innovative field indentation microprobe, 14:36984 (R;US)

Transport in metal alloys and resistivity saturation, 14:37695 (BA;US)
Understanding oxide-metal interfaces, 14:36620 (BA;FR)

METHANE
Characterization and subsequent utilization of microbially solubilized coal: Preliminary studies, 14:35519 (R;US)
Enhanced flame stability and soot radiation using electric fields. Annual report, July 1987-July 1988, 14:35687 (R;US)
Identification and characterization of reaction steps and enzyme catalysts involved in the conversion of acetate and methyl groups to methane. Final report, October 1984-October 1987, 14:35860 (R;US)
Measurement of static coalbed-reservoir conditions for hydraulic-fracture design. Volume 2. Final report, March 1983-December 1986, 14:35681 (R;US)
Methane desorption in coal handling, 14:35548 (R;CA)
Phase equilibrium data for development of correlations for coal fluids: Report for the period April 15, 1989–June 15, 1989, 14:35530 (R;US)
Sewage gas utilisation for cogeneration. Conference documentation, 14:36423 (R;DE;In German)

METHANE HYDRATES
See GAS HYDRATES

METHANOL
Conversion of methanol over zeolite ZSM-5, 14:35859 (R;ZA)
Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, January 15, 1989–April 15, 1989, 14:35553 (R;US)

METHYL ALCOHOL
See METHANOL

METHYL METHANESULFONATE
Mutation induction by MR(P) and its modification by various conditions, 14:37341 (RA;US)

METHYL RADICALS
Identification and characterization of reaction steps and enzyme catalysts involved in the conversion of acetate and methyl groups to methane. Final report, October 1984-October 1987, 14:35860 (R;US)

METHYL-FUEL
See ALCOHOLS
METHANOL

METHYLBENZENE
See TOLUENE

METHYLENE CHLORIDE
Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, January 15, 1989–April 15, 1989, 14:35553 (R;US)

METROPOLITAN AREAS
See URBAN AREAS

MHD CHANNELS
MHD plasma velocity measurement using correlation techniques, 14:36359 (BA;US)

MHD GENERATOR AERL MARK VII
Strategies for combatting problems caused by cathode slag shorting, 14:36353 (BA;US)
Voltage-current characteristics of the insulator gaps in a slagging MHD generator, 14:36354 (BA;US)

MHD GENERATOR CDIF
Coal-fired MHD power train performance test results, 14:36355 (BA;US)
Coal-fired MHD topping cycle test progress at the component development and integration facility, 14:36350 (BA;US)
Status report of 1A test train hardware performance and development, 14:36356 (BA;US)

MHD GENERATOR CFFF
Two dimensional modeling of fluid mechanics, heat transfer, and NO decomposition in the CFFF radiant furnace, 14:36358 (BA;US)

MHD GENERATORS
See also COAL-FIRED MHD GENERATORS
MHD GENERATOR AERL MARK VII
Advanced superconducting MHD magnet design for a retrofit power plant, 14:36918 (J;US)
Diagnostic development and support of MHD test facilities: Progress report, July–September 1987, 14:36345 (R;US)
Experimental investigation of factors affecting the cathode wall slag layer resegmentation frequency, 14:36351 (BA;US)
Materials tests in support of MHD steam bottoming plant, 14:36357 (BA;US)

MICE
Genetics of early embryo survival, 14:37314 (R;US)

MICROCOMPUTERS
Driver and controller for the Odrenok computer, 14:37085 (R;SU;In Russian)
Practical use of personal computer based methods for NPP operational safety assessment, 14:35979 (RA;XA)
SALP-PC - A fault tree code on personal computer for plant safety assessment, 14:35980 (RA;XA)

MICROPROCESSORS
A radiation-hardened 16/32-bit microprocessor, 14:37130 (R;US)
Power quality: a utility perspective, 14:36320 (RA;US)

MICROWAVE EQUIPMENT
See also SQUID DEVICES
Real-time optical processor for synthetic aperture radar image formation, 14:37020 (BA;US)

MIGRATION (RADIONUCLIDE)
See RADIONUCLIDE MIGRATION

MILITARY EQUIPMENT
Laboratory evaluation of MIL-T-83133 JP-8 fuel in army diesel engines. Interim report, October 1984-January 1988, 14:35666 (R;US)
Technology selection criteria and methodology for prioritizing energy research and development programs. Final report, 14:36252 (R;US)

MILITARY FACILITIES
Evaluation criteria guide for water-pollution prevention, control, and abatement programs. Technical manual, 14:37281 (R;US)

MILITARY STRATEGY
Postwar US conventional military policy: Lessons and implications for the seventh era and beyond, 14:36457 (R;US)

MILLING
Characterization of radioactive long-lived dust present in uranium mines and mills atmospheres, 14:35750 (RA;CA)

MINE ROADWAYS
The application of rock bolt design methods to a proposed 7 West crosscut, Prince Mine, Sydney Coalfield, N.S., 14:35568 (R;CA)

MINE-MOUTH GENERATING PLANTS
See COAL MINES
FOSSIL-FUEL POWER PLANTS

MINERAL INDUSTRY
Preliminary survey report: control technology support for sensor, Unimin Corporation, Dividing Creek Sand Plant, Millville, New Jersey, August 16, 1988, 14:37179 (R;US)

MINERAL RESOURCES
See also NATURAL GAS DEPOSITS
PETROLEUM DEPOSITS
URANIUM DEPOSITS
Central American resource studies, 14:36236 (R;US)
Potential supply of minerals from the White Mountains National Recreation Area and Part of the North Steese National Conservation Area Alaska. Appendix A- potential mineral supply analysis methodology, 14:36237 (R;US)

MINERALS
See also CARBONATE MINERALS
GARNETS
ZEOLITES
Alkalinity production in soil and rock: A useful concept for understanding acidification of soil and freshwater, 14:37259 (RA;NO)
Deformations in structure of the scapolites from northeast, Brazil, 14:36708 (R;BR;In Portuguese)

MINERS
Comparing personal alpha dosimetry with the conventional area monitoring-time weighting methods of exposure estimation: a Canadian assessment, 14:37641 (R;CA)

MINES
See also COAL MINES
URANIUM MINES
Identification of nonuranium mines which present a radon risk through measurements of exhaust air, 14:35834 (RA;CA)

MINING EQUIPMENT
See also CUTTING MACHINES
ROOF BOLTS
Survey of microprocessor based performance monitoring devices in Canadian surface coal and oil sands mines in 1987, 14:35572 (R;CA)

MINKOWSKI SPACE
Quantum mechanical stabilization of Minkowski signature wormholes, 14:37708 (R;US)

MISGURNUS
See FISHES

MIXED OXIDE FUELS
Remote-controlled NDA [nondestructive assay] systems for feed and product storage at an automated MOX [mixed oxide] facility, 14:35757 (R;US)

MIXER-SETTLERS
Recent advances in centrifugal contactor design, 14:35822 (J;US)

MM-0011
See NICKEL BASE ALLOYS

MMS
See METHYL METHANESULFONATE

MOBILE POLLUTANT SOURCES
Atmospheric modeling of air pollution. September 1984-March 1988 (Citations from the NTIS data base). Report for September 1984-March 1988, 14:37194 (R;US)

MODELS (COSMOLOGICAL)
See COSMOLOGICAL MODELS

MODELS (CRYSTAL)
See CRYSTAL MODELS

MODELS (MATHEMATICAL)
See MATHEMATICAL MODELS

MODELS (PLASMA)
See PLASMA SIMULATION

MODES (SINGLE-PARTICLE)
See SINGLE-PARTICLE MODES

MOLDS
See FUNGI

MOLECULAR STRUCTURE
A soliton mechanism for DNA melting: Progress report, November 1, 1988–October 31, 1989, 14:37298 (R;US)
Generating alignments of genetic sequences, 14:37285 (R;US)

MOLTEN IRON PUREGAS PROCESS
Behaviour of secondary and trace elements during coal gasification in an iron bath, 14:35534 (R;DE;In German)

MOLTEN SALT FUELED REACTORS
To the study of dynamics of a homogeneous reactor with circulating fuel, 14:36069 (RA;SU;In Russian)

MOLYBDATES
Connection between structure of alkali metal molybdates and tungstates and their spectral and energetic characteristics, 14:36763 (RA;SU;In Russian)
Double sodium molybdates with rubidium and cesium, 14:36767 (RA;SU;In Russian)
Enthalpies of melting and polymorphic transformations of alkali metal molybdates, tungstates, and chromates, 14:36761 (RA;SU;In Russian)
Interaction of thallium (1) and lithium molybdates (tungstates), 14:36766 (RA;SU;In Russian)
Phase equilibria in the systems Li_2MoO_4-$BaMoO_4$-$Ln_2(MoO_4)_3$, Ln=La-Lu, Y. Luminescence of $Li_3Ba_2Ln_3(MoO_4)_8$-Nd^{3+}, 14:36760 (RA;SU;In Russian)
Physicochemical features of Li_2MoO_4 and Li_2WO_4 behaviour under different methods of treatment, 14:36769 (RA;SU;In Russian)
Thermodynamic properties of alkali metal chalcogenates, chromates, molybdates, and tungstates, 14:36764 (RA;SU;In Russian)

MOLYBDENUM
Atomic structure of tilt boundaries in Mo bicrystals, 14:36486 (BA;FR)
Deactivation of hydrotreatment catalysts used for coal liquids: Semi-annual report, 12 May 1988–11 November 1988, 14:35525 (R;US)
Ion exchange and soil attenuation of Gulf Coast and Great Plains soils: Final report, 14:37217 (R;US)
Oxygen segregation in 32°[001] molybdenum tilt grain boundary. I. Segregation sites determination, 14:36502 (BA;FR)
Oxygen segregation in 32°[001] molybdenum tilt grain boundary. II. Enthalpies of segregation determination from AES and grain boundary grooves measurements, 14:36503 (BA;FR)
Theoretical investigations of phonon anomalies in fcc La and W(001), 14:36603 (D;US)

MOLYBDENUM 100 REACTIONS
Multiple angular scattering of heavy ions $^{16-17}O$, ^{40}Ar, ^{86}Kr, ^{100}Mo at intermediate energies (20-90 MeV/u), 14:37682 (R;FR)

MOLYBDENUM 100 TARGET
MSC calculations with use of EMPIRE, 14:37617 (RA;XA)

MOLYBDENUM 92 TARGET
MSC calculations with use of EMPIRE, 14:37617 (RA;XA)

MOLYBDENUM COMPLEXES
Metal extraction by amides of carboxylic acids, 14:36719 (RA;SU)

MOLYBDENUM OXIDES
Physicochemical study of interaction in the systems Li_2O-TeO_2-M_nO_m (M-Cr, Mo, Ti; n=1.2; m=2.3), 14:36762 (RA;SU;In Russian)

MOLYBDENUM SILICIDES
SiC-$MoSi_2$ composites, 14:36638 (R;US)

MOLYBDENUM SULFIDES
Atomic oxygen-MoS_2 chemical interactions, 14:36844 (R;US)

MONEL 400
A review of the Model 5A uranium hexafluoride cylinder, 14:35769 (R;US)

MONITORED RETRIEVABLE STORAGE
MRS system study summary report, 14:35783 (R;US)
Quarterly report on program cost and schedule: First quarter FY 1989, 14:35782 (R;US)

MONITORING
See also AEROSOL MONITORING
Pilot program for water quality data collection by volunteers, 14:35898 (R;US)

MONITORING NETWORK
See MONITORING

MONITORS (AIR POLLUTION)
See AIR POLLUTION MONITORS

MONITORS (BEAM)
See BEAM MONITORS

MONITORS (FAILED ELEMENTS)
See FAILED ELEMENT MONITORS

MONITORS (REACTOR)
See REACTOR CONTROL SYSTEMS

MONOCARBOXYLIC ACIDS
Nuclear Medicine Program progress report for quarter ending December 31, 1988, 14:37320 (R;US)

MONOCLONAL ANTIBODIES
UW 21/123 monoclonal antibody in the radioimmunological detection of tumour tissue in the head and neck region, 14:37318 (R;DE;In German)

MORTARS
Abrasion-erosion resistance of various repairing mortars, 14:36679 (R;CA)

MOS TRANSISTORS
Development of new type of silicon detector with internal amplification, 14:37117 (R;DE;In German)
The use of glass slides for preparing cross-section TEM samples of discrete transistors, 14:36687 (BA;US)

MOTION DETECTION SYSTEMS
Field evaluation of new exterior video motion detection systems, 14:36892 (R;US)

MOTOR VEHICLE ACCIDENTS
Chemical and nuclear emergencies: Interchanging lessons learned from planning and accident experience, 14:37344 (R;US)

MOTTELSON-NILSSON MODEL
See NILSSON-MOTTELSON MODEL

MOUNTAINS
See also APPALACHIAN MOUNTAINS
ROCKY MOUNTAINS
YUCCA MOUNTAIN
Geological and geophysical investigations at Sierra del Medio massif - Argentine, 14:37403 (R;AR)

MUCOSA
See MUCOUS MEMBRANES

MUCOUS MEMBRANES
Formation and prevention of destructive changes in mucous membranes of stomach of irradiated rats, 14:37360 (RA;SU;In Russian)

MULTI-PHOTON PROCESSES
Studies of collisional and nonlinear radiative processes for development of coherent uv and xuv sources. Final report, 30 September 1985-29 September 1988, 14:37463 (R;US)

MULTIGROUP THEORY
Implatation of MC2 computer code, 14:36068 (R;BR;In Portuguese)

MULTIPHASE FLOW
Time- and volume-averaged conservation equations for multiphase flow, 14:36979 (R;US)

MULTIPLE PRODUCTION
Multiplicity fluctuations in finite rapidity windows. Intermittency or quantum statistical correlation?, 14:37540 (J;NL)

MULTIPLICITY
Development of neutron multiplicity counters for safeguards assay, 14:35790 (R;US)

MULTIPROCESSING
See PARALLEL PROCESSING

MULTIPROCESSORS
See ARRAY PROCESSORS

MUNICIPAL WASTES
Final Environmental Impact Statement. Qaste reduction, recycling, and disposal alternatives. Recycling potential assessment and waste stream forecast. Volume 2, 14:36434 (R;US)
Guide to land treatment of municipal waste water in Illinois, 14:36433 (R;US)
Leaching characteristics of incinerator residues and potential for modification of leaching, 14:36431 (R;NL)
Liquid fuels from the pyrolysis of municipal solid waste and its components, 14:36442 (BA;US)
Ocean waste disposal: outfall sewers. January 1977-April 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-April 1989, 14:36441 (R;US)

MUON REACTIONS
Medium energy meson research, 14:37506 (R;US)

MUON-CATALYZED FUSION
Medium energy meson physics: [Progress report, 1981–1983], 14:37564 (R;US)

MUSCOVITE
Specimen cage modification for TEM in-situ shearing, 14:36693 (BA;US)

MUSEUMS
See EDUCATIONAL FACILITIES

MUTATIONS
See also CHROMOSOMAL ABERRATIONS
GENE MUTATIONS
SPONTANEOUS MUTATIONS
Energy and Technology Review, 14:37303 (R;US)
Mutation induction by MR(P) and its modification by various conditions, 14:37341 (RA;US)

N

NAI DETECTORS
Particle transport simulation for spaceborne, NaI gamma-ray spectrometers, 14:37129 (R;GB)

NAL SYNCHROTRON
See FERMILAB ACCELERATOR

NAPAP
National Air Audit System FY 1986-1987 national report. Final report, 14:37192 (R;US)
National Performance Audit Program; ambient air audits of analytical proficiency, 1987, 14:37189 (R;US)

NATIONAL ACCELERATOR LABORATORY
See FERMILAB ACCELERATOR

NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM
See NAPAP

NATIONAL DEFENSE
Postwar US conventional military policy: Lessons and implications for the seventh era and beyond, 14:36457 (R;US)

NATIONAL PROGRAM PLANS
Quarterly report on program cost and schedule: First quarter FY 1989, 14:35782 (R;US)

NATIONAL REACTOR TESTING STATION
See IDAHO NATIONAL ENGINEERING LABORATORY

NATURAL GAS
Annual outlook for oil and gas 1989, 14:35652 (R;US)
Canadian energy supply and demand, 1987-2005, 14:36260 (R;CA;In French)
Canadian energy supply and demand, 1987-2005, 14:36259 (R;CA)
DRI (Data Resources Inc.) Energy Model/GRI (Gas Research Institute) Hydrocarbon Model and IFCAM linkage. Final report, September 1983, 14:36265 (R;US)
DRI (Data Resources Inc.) Energy Model/GRI (Gas Research Institute) Hydrocarbon Model and IFCAM linkage. Final report, December 1984, 14:36268 (R;US)
Gas supply. Reference from the Lieutenant Governor in Council, 14:35678 (R;CA)
Transport and Storage (3.3) Subprogram for Gas Research Institute: status report - 1988 projects, 14:35684 (R;US)
Unconventional gas recovery program plan, FY 1989, 14:35667 (R;US)

NATURAL GAS DEPOSITS
See also NATURAL GAS FIELDS
Fracture-height growth containment using low-permeability bridging agents to stimulate tight gas sands with weak barriers. Topical report, January 1982-March 1985, 14:35680 (R;US)
Site selection for GRI (Gas Research Institute) cooperative tight-gas field research. Volume 1: screening of candidate tight gas formations. Topical report, May-July 1988, 14:35672 (R;US)

NATURAL GAS DISTRIBUTION SYSTEMS
Threshold-stress determination using tapered specimens and cyclic stresses, 14:35685 (BA;US)
Transport and Storage (3.3) Subprogram for Gas Research Institute: status report - 1988 projects, 14:35684 (R;US)

NATURAL GAS FIELDS
Cost effectiveness, 14:35656 (R;NO)
Reservoir Engineering and Treatment Design Technology. Annual report, December 1987-November 1988, 14:35676 (R;US)

NATURAL GAS FUEL CELLS
Solid-oxide fuel-cell technology development. Annual report, May 1, 1987-April 30, 1988, 14:36365 (R;US)

NATURAL GAS GATHERING SYSTEMS
See NATURAL GAS DISTRIBUTION SYSTEMS

NATURAL GAS INDUSTRY
Documentation and review of Eastern Gas Shales Technology. Annual report, April 1, 1984-March 31, 1985, 14:35671 (R;US)
GRI (Gas Research Institute) catalog of technical reports, 14:35668 (R;US)
Natural gas monthly: April 1989, 14:35674 (R;US)
Stretford chemistry and analytical methods handbook. Topical report, 14:35675 (R;US)

Study of data distributions and functions for the development of thermodynamic equations of state. Annual report, June 1987-May 1988, 14:35686 (R;US)
Technology 'Master List' data base management system. User's manual. Topical report, 14:35669 (R;US)
Transport and Storage (3.3) Subprogram for Gas Research Institute: status report - 1988 projects, 14:35684 (R;US)

NATURAL GAS LIQUIDS
Canadian energy supply and demand, 1987-2005, 14:36260 (R;CA;In French)
Canadian energy supply and demand, 1987-2005, 14:36259 (R;CA)
Petroleum supply annual 1988: Volume 1, 14:35651 (R;US)

NATURAL GAS WELLS
Influence of natural fractures on hydraulic fracture propagation, 14:35634 (B;US)
Unique completion practices in a horizontal well, 14:35679 (RA;CA)

NATURAL GASOLINE
See NATURAL GAS LIQUIDS

NATURAL MUTATIONS
See SPONTANEOUS MUTATIONS

NAVAL PETROLEUM RESERVE
The occurrence and status of candidate species listed by the US Fish and Wildlife Service on Naval Petroleum Reserve No. 1, Kern County, California, 14:37207 (R;US)

NAVAL REACTORS
See SHIP PROPULSION REACTORS

NAVIER-STOKES EQUATION
See NAVIER-STOKES EQUATIONS

NAVIER-STOKES EQUATIONS
Numerical solution of the Navier-Stokes equations for three-dimensional incompressible flows with open boundaries, 14:37484 (R;US)

NEGATIVE IONS
See ANIONS

NEGATONS
See ELECTRONS

NEGATRONS
See ELECTRONS

NEODYMIUM
Background correction in photothermal deflection spectroscopy using a single position sensor, 14:36850 (BA;US)

NEODYMIUM BORIDES
Fundamental magnetic studies of iron-rare-earth-metalloid alloys: Technical performance report, 14:36483 (R;US)

NEODYMIUM COMPLEXES
Studies of the influence of different anions on extraction of neodymium with di(1-methylheptyl)methyl phosphonate, 14:36826 (RA;SU)

NEODYMIUM COMPOUNDS
See also NEODYMIUM BORIDES
Phase equilibria in the systems Li_2MoO_4-$BaMoO_4$-$Ln_2(MoO_4)_3$, Ln=La-Lu, Y. Luminescence of $Li_3Ba_2Ln_3(MoO_4)_8$-Nd^{3+}, 14:36760 (RA;SU;In Russian)

NEODYMIUM LASERS
Multi-segment Nd:Glass disk amplifiers, 14:37782 (R;US)
Nd:Cr:GSGG, will it replace Nd:YAG, 14:36971 (BA;US)
Single-frequency microchip Nd lasers, 14:36960 (R;US)

NEOPLASMS
See also CARCINOMAS
Life-span effects of ionizing radiation in the beagle dog: A summary account of four decades of research funded by the US Department of Energy and its predecessor agencies, 14:37383 (R;US)

NEPAL
Andhi Khola Hydel and Rural Electrification Project (AHREP) Nepal. Low cost hydropower with maximum local training, 14:35871 (RA;CA)

NEPTUNIUM
Absorption, distribution, and fate of neptunium in plants, 14:37233 (J;US)

NEPTUNIUM COMPLEXES
Extraction properties of TBP - uranyl nitrate disolvate, 14:36718 (RA;SU)
Outer-sphere hydration of metal chelates and its role in liquid-liquid partition equilibria, 14:36821 (RA;SU)

NETHERLANDS
Dutch nuclear programme. Role of the Dutch industry, 14:36063 (R;NL)
Heat storage R&D in The Netherlands, 14:36243 (RA;CA;In English and French)

NETWORK ANALYSIS
The plant expert system (PLEXSYS) development environment: System description and user's manual, version 2: Final report, 14:36007 (R;US)

NETWORKS (COMPUTER)
See COMPUTER NETWORKS

NEUTRALIZATION (BEAM)
See BEAM NEUTRALIZATION

NEUTRALIZATION (CHEMICAL)
See PH VALUE

NEUTRINO DETECTION
Progress report of a research program in experimental high energy physics, January 1, 1989–December 31, 1989, 14:37500 (R;US)

NEUTRINO-ELECTRON INTERACTIONS
See also ANTINEUTRINO-ELECTRON INTERACTIONS
Elastic scattering of muon-neutrinos and muon-anti-neutrinos by electrons, 14:37499 (R;US)

NEUTRINOS
See also ELECTRON NEUTRINOS
SOLAR NEUTRINOS
Neutrino counting in single photon experiments, 14:37509 (R;FR)
Precision electroweak physics with neutrinos at Los Alamos, 14:37526 (R;US)
Research in nuclear physics at low and intermediate energies, neutrinos and x rays: Final report, May 1980–August 1987, 14:37563 (R;US)
Study of atmospheric neutrino interactions with the Frejus detector, 14:37706 (R;FR)

NEUTRON ACTIVATION ANALYSIS
See ACTIVATION ANALYSIS
NEUTRON REACTIONS

NEUTRON BEAMS
Intensity of DNA synthesis in immuno-competent organs of animals in early periods after neutron irradiation with different energy values, 14:37377 (R;SU;In Russian)
Neutron transmission of single crystal MgO filters, 14:37097 (J;NL)

NEUTRON CAPTURE
See NEUTRON REACTIONS

NEUTRON DETECTORS
Multi-energy neutron detector for counting thermal neutrons, high-energy neutrons, and gamma photons separately, 14:37133 (R;US)

NEUTRON DOSIMETRY
Calculated and measured depth dose profiles in a phantom exposed to neutron radiation fields, 14:37662 (R;US)
Intercomparison of neutron-dosimetry techniques at the AFFRI (Armed Forces Radiobiology Research Institute) TRIGA reactor, 14:37098 (R;US)

NEUTRON REACTIONS
See also FAST FISSION
Analysis of threshold reaction cross-sections and spectra of particles emitted in them on iron-group nuclei, 14:37618 (RA;XA)
Approximation of precompound effects in Hauser-Feshbach codes for calculating double differential (n, xn) cross sections, 14:37637 (J;US)
Investigation of the angular distribution of secondary energy dependent inelastic neutron cross sections in structural materials using Blann's geometry dependent hybrid model, 14:37619 (RA;XA)
MSC calculations with use of EMPIRE, 14:37617 (RA;XA)
Neutron optical model potential, 14:37615 (RA;XA)

Optical-model calculations for experimental interpretation and evaluation: Practical considerations and fundamental implications, 14:37614 (RA;XA)
Some fundamental aspects of the optical potential for the interaction of fast neutrons with cobalt, 14:37613 (RA;XA)

NEUTRON SLOWING-DOWN THEORY
Approximation of the slowing-down equation solution by the discontinuous finite element method, 14:36073 (RA;SU;In Russian)

NEUTRON SOURCE FACILITIES
Neutron generator based on adiabatic trap, 14:37769 (RA;SU;In Russian)

NEUTRON SPECTROMETERS
Neutron spectrometry measurements with large volume cylindrical proton-recoil counters developed for use in radiological protection, 14:37099 (R;GB)

NEUTRON TRANSPORT
DEMETRA-ES program, 14:36080 (RA;SU;In Russian)

NEUTRON-DEFICIENT ISOTOPES
Shape transition in neutron deficient PT isotopes, 14:37592 (R;FR)

NEUTRONS
See also FAST NEUTRONS
FISSION NEUTRONS
THERMAL NEUTRONS
Density dependence of the momentum distribution in normal liquid ^{4}He, 14:37639 (R;US)
Development of neutron multiplicity counters for safeguards assay, 14:35790 (R;US)
Multi-energy neutron detector for counting thermal neutrons, high-energy neutrons, and gamma photons separately, 14:37133 (R;US)

NEVADA
A database for reviews and evaluations of high-level waste documents, 14:35820 (BA;US)

NEVADA TEST SITE
Comparison of spectral data gathered from a laboratory spectrometer and TM images with and without shadow correction, 14:37404 (R;US)

NEWFOUNDLAND
Woodchip production and transporation in Newfundland. Overview, 14:35866 (RA;CA)

NGL
See NATURAL GAS LIQUIDS

NICKEL
Atom Transport
Solid-state interaction between nickel and $YBa_2Cu_3O_x$, 14:36646 (R;CA)
Binding Energy
Application of the embedded atom method to the fracture of interfaces, 14:36514 (BA;FR)
Cracks
Role of grain boundary structure on the electrochemical stability of passive films formed on high purity polycrystalline nickel, 14:36520 (BA;FR)
Deactivation
Deactivation of hydrotreatment catalysts used for coal liquids: Semi-annual report, 12 May 1988–11 November 1988, 14:35525 (R;US)
Deformation
Dynamic studies of deformation and fracture at grain boundaries, 14:36533 (BA;FR)
The response of single crystal and polycrystal nickel to quasistatic and shock deformation, 14:36573 (R;US)
Diffusion
Diffusion induced grain boundary migration in Ni(Zn) polycrystals, 14:36523 (BA;FR)
Grain boundary diffusion of Co and Ni in bicrystalline and polycrystalline NiO, 14:36633 (BA;FR)
Interdiffusion of Au/Ni/Cr on silicon substrate, 14:36529 (BA;FR)
TEM study of diffusion-induced grain boundary migration in Ni-Cu diffusion couples, 14:36530 (BA;FR)
Dislocations
Structure of small angle tilt boundaries and their behavior under the applied shear stresses in fcc metals, 14:36531 (BA;FR)
Dissolution
Impedance spectroscopy for the study of anodic copper dissolution in sulfuric acid in presence of benzotriazole, 14:36367 (BA;US)
Energy-Loss Spectroscopy
High resolution electron energy loss studies of surface vibrations: Progress report, July 1, 1988–June 20, 1989, 14:36481 (R;US)
Fractures
Dynamic studies of deformation and fracture at grain boundaries, 14:36533 (BA;FR)
Grain Boundaries
Common factors controlling grain and phase boundary energy, 14:36517 (BA;FR)
Experimental evidence of sulfur effect on the plane and on the extrinsic dislocations of a $\Sigma = 3$ grain boundary in nickel, 14:36504 (BA;FR)
Hydrogen segregation and diffusion at grain boundaries, 14:36501 (BA;FR)
Simulation study of interfaces in Ni, Al and Ni_3Al with and without boron, 14:36488 (BA;FR)
Unusual segregation behavior of boron and its effect on segregation of sulfur in nickel, 14:36508 (BA;FR)
Interfaces
Structure of Ni/MgO interfaces, 14:36489 (BA;FR)
Mechanical Properties
Special mechanical properties of very thin films, 14:36538 (BA;FR)
Microstructure
Segregation energies of phosphorus and sulfur in various relaxed structures of grain boundaries in Ni by tight-binding approximation, 14:36509 (BA;FR)
Phase Studies
Hetero phase boundaries in the silver-nickel system, 14:36515 (BA;FR)
Phase Transformations
Two dimensional phase equilibria at surfaces, 14:37671 (BA;FR)
Quantity Ratio
New ideas on interface structure from significant disagreements between experiments and prediction of interface composition in Ag base alloys, 14:36505 (BA;FR)
Recovery
Separation potential of solvent extraction in the recovery of metals, 14:35762 (BA;US)
Sample Preparation
The preparation of mechanically alloyed powders for TEM examination, 14:36596 (BA;US)
Segregation
Enhanced concentrations of Ni at grain boundary dislocations in Ni-treated W, 14:36511 (BA;FR)
Spatial Distribution
Electron microscopy studies of diffusion-induced grain boundary migration in ceramics, 14:36535 (BA;FR)
Surface Properties
Structural and surface characterization of dispersed metal catalysts: Final report, September 1, 1986–December 31, 1988, 14:36482 (R;US)
Surfaces
Unusual segregation behavior of boron and its effect on segregation of sulfur in nickel, 14:36508 (BA;FR)
Trace Amounts
Trace metal removal by iron coprecipitation: Field evaluation: Final report, 14:35960 (R;US)

NICKEL 60 TARGET
Analysis of threshold reaction cross-sections and spectra of particles emitted in them on iron-group nuclei, 14:37618 (RA;XA)

NICKEL ALLOYS
See also KOVAR
NICKEL BASE ALLOYS
Application of the embedded atom method to the fracture of interfaces, 14:36514 (BA;FR)

Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1, 14:35538 (R;US)
Development of an engineering definition of the extent of J singularity controlled crack growth, 14:36579 (R;US)
Dynamic studies of deformation and fracture at grain boundaries, 14:36533 (BA;FR)
Electronic theory for grain boundary segregation and embrittlement of intermetallic compound Ni_3Al, 14:36518 (BA;FR)
Grain boundary chemistry contributions to intergranular hot cracking, 14:36513 (BA;FR)
Grain boundary internal friction and relationship to intergranular fracture, 14:36521 (BA;FR)
Grain boundary structure in Ni_3Al, 14:36492 (BA;FR)
Interfaces in composites reinforced with rapidly solidified metallic ribbons, 14:36495 (BA;FR)
Interfacial structure modifications induced by sulfur in Ag-Ni alloys, 14:36506 (BA;FR)
Microstructural refinement of W-Ni-Fe heavy alloys by alloying additions, 14:36462 (R;US)
Studies on work-softening processes in the hot forming of austenitic steel, 14:36581 (TJ;US)
Sulfidation/oxidation properties of iron-based alloys containing niobium and aluminum, 14:35539 (R;US)
The nature and composition of the passive film formed on Ni-P-Cr metallic glasses, 14:36366 (BA;US)

NICKEL BASE ALLOYS
See also MONEL 400
Effect of chromium on early stages of oxidation of Ni_3Al alloys at 600°C, 14:36608 (J;US)
[2nd international symposium on high-temperature corrosion of advanced materials and coatings, Les Embiez, France, May 22–26, 1989]: Foreign trip report, 14:35537 (R;US)

NICKEL OXIDES
Core structure of CSL boundaries in NiO, 14:36627 (BA;FR)
Electron microscopy studies of diffusion-induced grain boundary migration in ceramics, 14:36535 (BA;FR)
Equilibrium crystal shapes and surface phase diagrams at surfaces in ceramics, 14:36631 (BA;FR)
Grain boundary diffusion of Co and Ni in bicrystalline and polycrystalline NiO, 14:36633 (BA;FR)
Hetero- and homo-phase boundaries in ceramic oxides, 14:36626 (BA;FR)

NICKEL-CHROMIUM STEELS
Methods of calculation of weldpool surface form on the reverse side of plate under welding by impulse penetrative arc, 14:36560 (RA;SU;In Russian)

NICOTINE
Development of radioimmunological methods to determine the constituents of nicotiana plants and cell cultures, 14:37299 (R;DE;In German)

NILSSON MODEL
See NILSSON-MOTTELSON MODEL

NILSSON POTENTIAL
See NILSSON-MOTTELSON MODEL

NILSSON SCHEME
See NILSSON-MOTTELSON MODEL

NILSSON-MOTTELSON MODEL
On the feeding and spectroscopy of superdeformed states, 14:37635 (R;SE)

NIOBATES
Kinetics of lithium niobate interaction with molten ammonium hydrodifluoride, 14:36773 (RA;SU;In Russian)

NIOBIUM
Approximation of precompound effects in Hauser-Feshbach codes for calculating double differential (n, xn) cross sections, 14:37637 (J;US)
Atomic resolution observations of solute-atom segregation and two-dimensional phase transitions at internal interfaces, 14:36512 (BA;FR)
Effect of construction of current and gas supply on protective atmosphere composition in welded installation, 14:36565 (RA;SU;In Russian)
Effect of noble gases on the properties of ion-beam-sputtered niobium films, 14:36465 (R;US)
The preparation of mechanically alloyed powders for TEM examination, 14:36596 (BA;US)

NIOBIUM 93 REACTIONS
Heavy ion reaction studies of Nb_Au at E/A = 50, 75 and 100 MeV, 14:37600 (J;NL)

NIOBIUM ALLOYS
See also NIOBIUM BASE ALLOYS
Atomic resolution observations of solute-atom segregation and two-dimensional phase transitions at internal interfaces, 14:36512 (BA;FR)
Current capacity degradation in superconducting cable strands, 14:36940 (J;US)
Flux creep in a Tevatron cable, 14:36932 (J;US)
Preparation of in situ Cu-Nb composite sheet and wire for TEM analysis, 14:36599 (BA;US)
Sulfidation/oxidation properties of iron-based alloys containing niobium and aluminum, 14:35539 (R;US)

NIOBIUM BASE ALLOYS
Intermediate scale industrially processed Nb_3Sn(Ti) by powder metallurgy, 14:36941 (J;US)
Reaction kinetics of phase formation in Nb-Al powder metallurgy processed wire, 14:36944 (J;US)

NIOBIUM COMPLEXES
Metal extraction by amides of carboxylic acids, 14:36719 (RA;SU)

NIOBIUM OXIDES
Features of solid-phase interaction between lithium carbonate and niobium pentoxide hydrate, 14:36776 (RA;SU;In Russian)
Regularities of structure and properties of mixed oxides of the composition $ABTeO_6$ (A-K, Rb, Cs, Tl; B-Nb, Ta, Sb), 14:36795 (RA;SU;In Russian)

NITRATES
See also CADMIUM NITRATES
CESIUM NITRATES
PETN
THALLIUM NITRATES
URANYL NITRATES
YTTRIUM NITRATES
National Performance Audit Program; ambient air audits of analytical proficiency, 1987, 14:37189 (R;US)
Trajectory analysis of nine years of precipitation chemistry in Charlottesville, Virginia: Final report, 14:37165 (R;US)

NITRIC OXIDE
Investigation of the production of nitric oxide by soft solar x rays in the e-region of the ionosphere. Master's thesis, 14:37449 (R;US)

NITRO COMPOUNDS
Effects of DNA damage on transcription and transposition of Ty retrotransposons of yeast, 14:37386 (RA;US)

NITROGEN
Charged particle activation analysis of light elements, 14:36721 (RA;JP;In Japanese)

NITROGEN 12 TARGET
Excitation of the Δ resonance in heavy ion charge exchange reactions, 14:37628 (R;FR)

NITROGEN COMPOUNDS
See also NITRATES
NITROGEN OXIDES
Acidification and water pathways. What about the future?, 14:37273 (RA;NO)

NITROGEN DIOXIDE
Effects of air pollutants on the composition of stable carbon isotopes $\delta^{13}C$, of leaves and wood, and on leaf injury, 14:37396 (J;US)
Errors in grab sample measurements of N_2O from combustion sources, 14:37197 (J;US)

NITROGEN NITRIDES
See NITROGEN

NITROGEN OXIDES
See also NITRIC OXIDE
NITROGEN DIOXIDE
NITROUS OXIDE

Development of a membrane SO_x/NO_x treatment system: Final report, 28 April 1987–28 April 1988, 14:35957 (R;US)
Effects of trace gases on global atmospheric chemical and physical processes, 14:37195 (R;US)
Multiphoton ionization of $(Xe)_n$ and $(NO)_n$ clusters using a picosecond laser, 14:37464 (R;US)

NITROSOUREAS
Mutation induction by MR(P) and its modification by various conditions, 14:37341 (RA;US)

NITROUS OXIDE
Health-hazard evaluation determination report No. 75-151-259, Winchester Hospital, Winchester, Massachusetts, 14:37184 (R;US)

NMR IMAGING
New possibilities and aspects of NMR diagnosis by ultralow field NMR imaging, 14:37317 (RA;DD;In German)

NOBLE GASES
See RARE GASES

NOISE POLLUTION ABATEMENT
Eligibility of noise-abatement proposals for grants-in-aid under the airport improvement program, 14:37398 (R;US)

NOISE POLLUTION CONTROL
Examination of noise-management approaches in the United States. Final report, 14:37399 (R;US)

NON-PROLIFERATION POLICY
Challenges to the nonproliferation regime into the 21st Century: Conference summary, 14:36454 (R;US)

NON-PROLIFERATION TREATY
Non-proliferation regime, vertical proliferation and the interests of the Federal Republic of Germany, 14:36247 (R;DE;In German)

NONAXIAL NUCLEI
See DEFORMED NUCLEI

NONDESTRUCTIVE TESTING
Nondestructive testing for microelectronics, semiconductors, and superconductors. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:36993 (R;US)

NONRADIOACTIVE WASTE DISPOSAL
See WASTE DISPOSAL

NORTHERN IRELAND
See UNITED KINGDOM

NORTHWEST TERRITORIES
NOGAP C-11A. Sediment regime of lakes in the Mackenzie Delta, 14:37234 (R;CA)
Proceedings of the technology transfer workshop [for] northern water quality monitoring, 14:37256 (R;CA)

NOVA SCOTIA
Report on Working Group deliberations: Water quality group, 14:37215 (R;US)

NOVAE
1981 outburst of the old nova GK persei, 14:37436 (RA;FR)
Observations and simulations of Nova Vul 1984 2: a Nova with ejecta rich in oxygen, neon, and magnesium, 14:37437 (RA;FR)

NRTS
See IDAHO NATIONAL ENGINEERING LABORATORY

NUCLEAR ATTACKS
See NUCLEAR WEAPONS

NUCLEAR CONTROVERSY
See HAZARDS
HUMAN POPULATIONS

NUCLEAR DATA COLLECTIONS
GRVKON-6 applied program package for calculation of neutron group constants, 14:37626 (RA;SU;In Russian)

NUCLEAR DEFORMATION
On the feeding and spectroscopy of superdeformed states, 14:37635 (R;SE)

NUCLEAR DISARMAMENT
Non-proliferation regime, vertical proliferation and the interests of the Federal Republic of Germany, 14:36247 (R;DE;In German)

NUCLEAR ENGINEERING
Degree education on-site, on-line, on-time, 14:36066 (RA;US)
Intelligent robotics and remot systems for the nuclear industry, 14:37816 (J;NL)
Simulator application in a nuclear technology degree program, 14:36067 (RA;US)

NUCLEAR EXPLOSIONS
Centrifuge tests on simulation of the "cookie cutter" mechanism of chimney collapse into underground openings: Final report, 14:37159 (R;US)
Electron beam propagation in inhomogeneous media, 14:37747 (BA;US)
Neutrons and gamma transport in atmosphere by Tripoli-2 code. Energy deposit and electron current time function, 14:37156 (R;FR;In French)
Radiation exposure inside reinforced concrete buildings at Nagasaki, 14:37381 (R;US)
Some aspects of Starfish, 14:37154 (R;US)
Study of coupling in Starfish, 14:37155 (R;US)

NUCLEAR FACILITIES
See also FUEL FABRICATION PLANTS
FUEL REPROCESSING PLANTS
NUCLEAR POWER PLANTS
RADIOACTIVE WASTE FACILITIES
Application of process monitoring to verify facility design, 14:35839 (R;US)
Computer based training state of the art systems, 14:35826 (RA;US)
Guidelines for quality records in electronic media for nuclear facilities (NCIG-10): Final report, 14:36047 (R;US)
Indoctrination: using interactive video to teach attitudes and knowledge in general employee training, 14:35827 (RA;US)
Managing hazards and evaluating safety in nuclear facilities, 14:35746 (BA;DE)
Nuclear health and safety, 14:35831 (R;US)
Radiological surveys of Naval Facilities on Puget Sound, 14:37278 (R;US)

NUCLEAR FUEL ELEMENTS
See FUEL ELEMENTS

NUCLEAR FUELS
See also SPENT FUELS
ASTM C-26 committee and standards development, 14:35745 (R;US)
Application of process monitoring to verify facility design, 14:35839 (R;US)
Target cueing and tracking system for safeguards and security, 14:35851 (R;US)
Unattended mode operation of specialized NDA [nondestructive assay] systems, 14:35756 (R;US)
Unique applications of tamper indicating devices, 14:35840 (R;US)

NUCLEAR MATERIALS DIVERSION
The assess facility descriptor module, 14:35847 (R;US)

NUCLEAR MATERIALS MANAGEMENT
A demonstration of ASSESS: Analytic System and Software for Evaluating Safeguards and Security, 14:35850 (R;US)
Argonne Unified Safeguard: An integrated materials monitoring/tracking and accounting system, 14:35846 (R;US)
HEU [highly enriched uranium] drum monitor manual (for confirmatory measurements), 14:35768 (R;US)
Use of nuclear material control specialists for material surveillance, 14:35844 (R;US)

NUCLEAR MEDICINE
See also RADIOLOGY
Guidelines for the practice of radiopharmacy, 14:36857 (R;AU)

NUCLEAR PHYSICS
1987 ILL experimental reports and theory college activities, 14:37417 (R;FR)
CEBAF/SURA 1984 summer workshop: Proceedings, 14:37031 (R;US)
HUGS at CEBAF [Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility] June 6–24, 1988: Proceedings, 14:37568 (R;US)
Ninth conference of Czechoslovak physicists. Part 1, 2, 14:37678 (R;CS;In Czech, Slovak)
Nuclear physics workshop, 14:37561 (R;AR;In Spanish, English, Portuguese)

Research in nuclear physics at low and intermediate energies, neutrinos and x rays: Final report, May 1980–August 1987, 14:37563 (R;US)

NUCLEAR POWER

The economics of nuclear power: further evidence on learning, economies of scale, and regulatory effects, 14:36064 (J;NL).

NUCLEAR POWER PLANTS

Buildings

Method for calculating plane reinforced concrete elements of walls and ceilings in power plant structures under limiting loads, 14:36088 (RA;SU;In Russian)

Construction

The economics of nuclear power: further evidence on learning, economies of scale, and regulatory effects, 14:36064 (J;NL)

Containment Buildings

Static load cycle testing of a low-aspect-ratio six-inch wall TRG-type structure TRG-4-6 (1.0, 0.25), 14:36091 (R;US)

Data Base Management

Organization of Risk Analysis Codes for Living Evaluations (ORACLE), 14:36053 (BA;DE)

Earthquakes

Overview of the development of seismic safety assessment techniques for nuclear power plants, 14:36169 (BA;DE)

Seismic margin screening insights for light water reactors, 14:36170 (BA;DE)

Emergency Plans

Developing a systematic approach to team training for emergency response personnel, 14:36135 (RA;US)

Failed Element Detection

On some methods of NPP functional diagnostics, 14:36102 (RA;SU;In Russian)

Structural redundance of NPPs and diagnostics, 14:36101 (RA;SU;In Russian)

Fasteners

Compilation of fastener testing data received in response to NRC Compliance Bulletin 87-02, 14:36051 (R;US)

Information Systems

Guidelines for quality records in electronic media for nuclear facilities (NCIG-10): Final report, 14:36047 (R;US)

Low Dose Irradiation

Occupational dose reduction at nuclear power plants: Annotated bibliography of selected readings in radiation protection and ALARA: Volume 4, 14:36159 (R;US)

Mechanical Structures

Determining the carrying capability of composite plates in power plant structures taking into account attenuating effect of joints in them, 14:36089 (RA;SU;In Russian)

Network Analysis

The plant expert system (PLEXSYS) development environment: System description and user's manual, version 2: Final report, 14:36007 (R;US)

Nuclear Materials Management

Closeout of IE Bulletin 83-06: Nonconforming materials supplied by Tube-Line Corporation Facilities at Long Island City, New York; Houston, Texas; and Carol Stream, Illinois, 14:35841 (R;US)

Occupational Safety

Fitness for duty in the nuclear power industry: Responses to public comments, 14:36052 (R;US)

Operation

Annual radiological environmental operating report, Sequoyah Nuclear Plant, 1988, 14:37230 (R;US)

Pipes

A review of recent developments in pipe damping allowable values for United States nuclear plants, 14:35990 (R;US)

Comparison of analysis and vibration test results for a multiple supported piping system, 14:36143 (R;US)

Primary Coolant Circuits

Reinforced confinement in a nuclear reactor, 14:36012 (TG;US)

Quality Assurance

Application of quality principles to training of QA audit personnel, 14:36059 (RA;US)

Performance based training for quality surveillance personnel, 14:36058 (RA;US)

Relating quality at work to quality at home, 14:35755 (RA;US)

Quality Control

ASQC support of the quality profession in the utility industry - is it sufficient?, 14:36060 (RA;US)

Radiation Protection

Data base on dose reduction research projects for nuclear power plants: Volume 3, 14:36160 (R;US)

Reactor Accidents

Aerosol sampling and Transport Efficiency Calculation (ASTEC) and application to surtsey/DCH aerosol sampling system: Code version 1.0: Code description and user's manual, 14:36163 (R;US)

Health effects models for nuclear power plant accident consequence analysis: Low LET radiation: Part 2, Scientific bases for health effects models, 14:37380 (R;US)

Reactor Components

Results of the initial phase of the INEL/USNRC large bore hydraulic snubber reliability evaluation program, 14:36144 (R;US)

Reactor Cooling Systems

Nuclear plant service water system aging degradation assessment: Phase 1, 14:36166 (R;US)

Reactor Instrumentation

Surveillance of instrumentation channels at nuclear power plants: Volume 2, An approach to classifying problems and solutions: Final report, 14:36095 (R;US)

Reactor Maintenance

Team maintenance as a result of team training, 14:36057 (RA;US)

Reactor Operation

Licensed operating reactors status summary report, data as of April 30, 1989, 14:35984 (R;US)

Reactor Operators

Evaluating learning strategies in operator training programs, 14:36062 (RA;US)

Feasibility of quantitative performance measures for evaluating nuclear power plant operators, 14:36046 (RA;US)

Frustration, the challenge and the victory of team building, 14:36045 (RA;US)

Industry activities on operator requalification, 14:36043 (RA;US)

Lessons learned from three years of operator team skills training, 14:36044 (RA;US)

Managing instructor training to achieve excellence, 14:36061 (RA;US)

New performance-based examination program for licensed reactor operators, 14:36042 (RA;US)

Simulation facility evaluation program, 14:36039 (RA;US)

Simulator instructor training - a case of utility teamwork, 14:36041 (RA;US)

Three alternative simulation systems for training nuclear power plant personnel, 14:36040 (RA;US)

Training management - lessons learned, 14:36056 (RA;US)

Training management systems - a comparison, 14:36055 (RA;US)

Training: expectations of an operations superintendent, 14:36054 (RA;US)

Reactor Protection Systems

Closeout of IE Bulletin 80-09: Hydramotor actuator deficiencies, 14:36164 (R;US)

Reactor Safety

Changing organizational cultures - creating quality achievers through training and teamwork, 14:36136 (RA;US)

Fitness for duty in the nuclear power industry: A review of technical issues, 14:36162 (R;US)

Research in operations: operator reliability experiments, 14:36133 (RA;US)

Role of environmental qualification training in nuclear plant maintenance, 14:36140 (RA;US)

Risk Assessment

PRISIM - a plant risk status information management system for NRC inspectors, 14:36182 (BA;DE)

Safety

Reviewing surveillance activities in nuclear power plants. Supplementary guidance and reference material for IAEA Operational Safety Review Teams (OSARTs), 14:36147 (R;XA)

Seismic Effects
Recommendations for resolution of public comments on USI [Unresolved Safety Issues] A-40, "Seismic Design Criteria", 14:36165 (R;US)
Specifications
Development of alternate visual examination requirements for dynamic restraints (snubbers), 14:36129 (R;US)
Steam Generators
A finite-element model for eddy-current nondestructive evaluation: Final report, 14:36086 (R;US)

NUCLEAR POWER STATIONS
See NUCLEAR POWER PLANTS

NUCLEAR REACTIONS
See also FISSION
HADRON REACTIONS
THERMONUCLEAR REACTIONS
Generalised exciton model theories for the description of pre-equilibrium angular distributions, 14:37620 (R;IT)

NUCLEAR SAFETY
See RADIATION PROTECTION

NUCLEAR WASTES
See RADIOACTIVE WASTES

NUCLEAR WEAPON TESTS
See NUCLEAR EXPLOSIONS

NUCLEAR WEAPONS
Communication techniques for safely transmitting and verifying unique signals, 14:37157 (R;US)
Ethics and nuclear weapons research, 14:36460 (R;US)
Impact upon US security of a South African nuclear-weapons capability. Final technical report, 14:36458 (R;US)
Possible roles of tactical nuclear weapons in maritime conflict, 14:36459 (R;US)
Sensitivity/uncertainty analysis for free-in-air tissue kerma due to initial radiation at Hiroshima and Nagasaki, 14:36196 (J;US)
Vulnerability inducing technologies: An initial appreciation, 14:36455 (R;US)

NUCLEAR WEAPONS PROLIFERATION
See PROLIFERATION

NUCLEI
See also DEFORMED NUCLEI
HEAVY NUCLEI
INTERMEDIATE MASS NUCLEI
Physics of spin-polarized atomic vapors. Final report, 1 October 1986-30 April 1988, 14:37461 (R;US)

NUCLEON-NUCLEON INTERACTIONS
Transition between phenomena governed by the mean field and those governed by nucleon-nucleon collisions in the reaction $^{40}Ar + ^{68}Zn$, 14:37580 (R;FR;In French)

NUCLEONS
See also NEUTRONS
PROTONS
Nucleon as a color magnetic soliton, 14:37621 (RA;ZA)
Results of the Frejus experiment on nucleon decay, 14:37707 (R;FR)

NUCLIDES
See ISOTOPES

NUTS (MECHANICAL)
See FASTENERS

O

O CODES
Application of probabilistic fracture mechanics to the pressurized-thermal-shock issue, 14:36168 (BA;US)

OAK RIDGE NATIONAL LABORATORY
See ORNL

OCCLUSION COMPLEXES
See CLATHRATES

OCCUPATIONAL DISEASES
Quick-response evaluation of energy-related occupational safety and health programs. Task Order 1: mortality study of 50 workers exposed to coal-liquefaction processes at a Union Carbide Plant, Institute, West Virginia, 14:35541 (R;US)

OCCUPATIONAL EXPOSURE
Further studies of respiratory health of wool textile workers. Final report, October 1986-July 1988, 14:37191 (R;GB)
Hazard Communication Project: reference manual, 14:37330 (R;US)
Health-hazard evaluation determination report No. 73-185-256, Electromotive-Division, GMC (Plant 2), Chicago, Illinois, 14:37186 (R;US)
Health-hazard evaluation determination report No. 74-78-297, Amax Speciality Metals, Parkersburg, West Virginia, 14:37185 (R;US)
Health-hazard evaluation determination report No. 75-151-259, Winchester Hospital, Winchester, Massachusetts, 14:37184 (R;US)
Health-hazard evaluation determination report No. 75-178-295, New York Telephone and Telegraph Company, 770 Broadway, New York, New York, 14:37183 (R;US)

OCCUPATIONAL SAFETY
Guidelines for preparing a contractor safety plan, 14:37402 (R;US)
Hazard Communication Project: reference manual, 14:37330 (R;US)

OCONEE-1 REACTOR
Annual critique: an effective program evaluation tool, 14:36139 (RA;US)

OCONEE-2 REACTOR
Annual critique: an effective program evaluation tool, 14:36139 (RA;US)

OCONEE-3 REACTOR
Annual critique: an effective program evaluation tool, 14:36139 (RA;US)

OFF-PEAK ENERGY STORAGE
Thermal energy storage: An application guide for local governments, 14:36197 (R;US)

OGRA
Chamber cleaning by glow discharge as a means of the outgassing rate reducing under fast hydrogen atom beam irradiation, 14:37765 (RA;SU;In Russian)

OIL FIELDS
Cost effectiveness, 14:35656 (R;NO)

OIL RESIDUES
See PETROLEUM RESIDUES

OIL SAND DEPOSITS
See also ATHABASCA DEPOSIT
COLD LAKE DEPOSIT
A theoretical and experimental study of steam-assisted gravity drainage process, 14:35709 (RA;CA)
Experimental design for non-equilibrium immiscible carbon dioxide flood, 14:35603 (RA;CA)
Optimization of heavy oil thermorecovery made possible with a novel in-situ process, 14:35715 (RA;CA)
Optimum cementing and gravel packing methods for unconsolidated heavy oil sands, 14:35710 (RA;CA)
Prevention of formation damage through injection and production practices in heavy oil reservoirs, 14:35726 (RA;CA)
Ultrashort radius radial system. A new drilling and completion method for rapid development of oil sands reservoirs, 14:35609 (RA;CA)

OIL SAND INDUSTRY
AOSTRA underground test facility: mining access for research and production, 14:35721 (RA;CA)

OIL SAND MINING
CANMET review 1986-1987, 14:36239 (R;CA;In English and French)
Environmental mediation in major oil sands developments. An alternative model to resolution of native, corporate and government interests in resource development approval processes, 14:35741 (RA;CA)
Oil sands project application. Review process-mediation, not confrontation, 14:35743 (RA;CA)
Positive effects of the bemolanga tar sands exploitation, 14:35737 (RA;CA)

OIL SAND OILS
See BITUMENS

OIL SAND TAILINGS
Electrocoagulation of tar sand tailings pond waters, 14:35740 (RA;CA)
Insolation and characterization of non-bituminous organic materials which may interfere with recovery of bitumen from oil sands, 14:35716 (RA;CA)
The development of shear strength in sludge/clay shale mixes for oil sands tailings disposal, 14:35738 (RA;CA)

OIL SANDS
Chemical Composition
Comparative study of organic rich solids present in Utah and Athabasca oil sands, 14:35733 (RA;CA)
Coking
Coking of oil sand, asphaltenes and residual oils in the LR-process, 14:35705 (RA;CA)
Conservation Laws
New oil sands conservation regulations for Alberta, 14:35744 (RA;CA)
Dilatancy
Shear dilatency and permeability enhancement in oil sands, 14:35735 (RA;CA)
Fluid Injection
Modelling of fracture and deformation processes in oil sands, 14:37415 (RA;CA)
Fracture Mechanics
Modelling of fracture and deformation processes in oil sands, 14:37415 (RA;CA)
Hot-Water Processes
Athabasca mineable oil sands. The RTR/Gulf extraction process theoretical model of bitumen detachment, 14:35717 (RA;CA)
In defense of the Clark hot water process, 14:35719 (RA;CA)
Selection and evaluation of diluents in the modified hot water process, 14:35718 (RA;CA)
Mechanical Properties
Regional characterization of geomechanical properties of unconsolidated sands of the heavy oil belt, Venezuela, 14:35734 (RA;CA)
Meetings
UNITAR/UNDP, 4th international conference on heavy crude and tar sand. Vol. 1, 14:35702 (R;CA)
UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2, 14:35689 (R;CA)
Permeability
Shear dilatency and permeability enhancement in oil sands, 14:35735 (RA;CA)
Plugging
Reservoir plugging/blocking using ultramicrobacteria: Three-dimensional physical simulator results, 14:35707 (RA;CA)
Regulations
New oil sands conservation regulations for Alberta, 14:35744 (RA;CA)
Research Programs
Tar sands program plan, FY 1989, 14:35692 (R;US)
Resource Management
Onshore federal reservoir management program and the relationship to heavy crude and tar sands in California, 14:35742 (RA;CA)
Soil Mechanics
UNITAR/UNDP, 4th international conference on heavy crude and tar sand. Vol. 1, 14:35702 (R;CA)
Steam Injection
UNITAR/UNDP, 4th international conference on heavy crude and tar sand. Vol. 1, 14:35702 (R;CA)
Well Casings
The development of Mod N-80HO casing for cyclical steam stimulation, 14:36470 (RA;CA)
X-Ray Radiography
Practical applications of X-radiography techniques in tar sands, 14:35732 (RA;CA)

OIL SHALE WASTE WATER
See OIL SHALES
WASTE WATER

OIL SHALES
See also BLACK SHALES
Lawrence Livermore National Laboratory oil shale quarterly report, January–March 1989, 14:35731 (R;US)
Modifications of existing testing facilities, optimization of hydroretorting conditions, and assessment of Canadian oil shales as source of synthetic fuels. Final report, 14:35730 (R;CA)
Onshore federal reservoir management program and the relationship to heavy crude and tar sands in California, 14:35742 (RA;CA)

OIL SPILL FINGERPRINTING
See OIL SPILLS

OIL SPILLS
Oil at shore and in deposits. Succesive report 1987, 14:35662 (R;NO;In Norwegian)

OIL WELLS
Analysis of thermal well pumping performance at the Norcen-Bodo steam pilot, 14:35624 (RA;CA)
Composite media prepacks for sand control in heavy oil production, 14:35621 (RA;CA)
Corrosion inhibition in sour media, 14:36469 (R;CA)
Influence of natural fractures on hydraulic fracture propagation, 14:35634 (B;US)
Optimum cementing and gravel packing methods for unconsolidated heavy oil sands, 14:35710 (RA;CA)
Production of ERW L80 for enhanced recovery wells, 14:36471 (RA;CA)
Sand control with geotextile filters, 14:35628 (RA;CA)
The role of combustion gases in recovering oil in in-situ combustion processes, 14:35629 (RA;CA)

OKLAHOMA
Post-Pennsylvanian reactivation along the Washita Valley fault, southern Oklahoma, 14:37411 (R;US)

OMEGA-1778 RESONANCES
See MESONS

ON-LINE CONTROL SYSTEMS
Experience in using the in-situ subsystem providing reactor operation in on-line control system of the Smolensk NPP, 14:36106 (RA;SU;In Russian)
Some mathematical aspects of creation of the control system for a physical installation. Analytical review, 14:37076 (R;SU;In Russian)

ON-LINE MEASUREMENT SYSTEMS
Advanced instrument development: a case study. Heavy water monitors: the second generation, 14:36026 (R;CA)
Measuring RF field distribution in the 4-chamber H-resonator using microcomputer, 14:37083 (RA;SU;In Russian)

ONCOGENIC VIRUSES
See also LEUKEMIA VIRUSES
HTLV-I, HIV, and human T cell growth, 14:37329 (RA;US)

ONTARIO
See also ELLIOT LAKE
A Citizen's guide to environmental assessment, 14:36270 (R;CA)
Acid rain and agricultural production in Ontario, 14:37218 (RA;CA)
Effects of climatic change on agricultural land resource potential, 14:37167 (RA;CA)
Gas supply. Reference from the Lieutenant Governor in Council, 14:35678 (R;CA)
General economic stimulation and energy indicators for capital investment initiatives in various transportation modes, 14:36229 (R;CA)

OOCYTES
Comparative radiosensitivity of oocytes of various stages of maturity, 14:37361 (RA;SU;In Russian)

OPEN PLASMA DEVICES
Plasma storage in the Yupiter-2M multislit electromagnetic trap, 14:37722 (RA;SU;In Russian)

OPERATING COST
Management Information Database System, 14:37822 (R;US)

OPERATION (REACTOR)
See REACTOR OPERATION

OPTICAL COMPUTERS
Thin-film optics for signal-processing applications. Final report, 1 September 1986-31 May 1988, 14:36999 (R;US)

OPTICAL EQUIPMENT
Thin-film optics for signal-processing applications. Final report, 1 September 1986-31 May 1988, 14:36999 (R;US)

OPTICAL FIBERS
Mechanical degradation of polymer coated glass optical fibres under γ irradiation, 14:37128 (R;GB)

ORGANIC ACIDS
See also CARBOXYLIC ACIDS
SULFONIC ACIDS
Prediction and control of extraction ability and some physicochemical properties of extractants (Solvent extraction of actinides and rare earths.), 14:36859 (RA;SU)

ORGANIC COMPOUNDS
See also AMINES
AROMATICS
HYDROCARBONS
KETONES
ORGANIC ACIDS
ORGANIC PHOSPHORUS COMPOUNDS
ORGANIC POLYMERS
ORGANIC SULFUR COMPOUNDS
ORGANOMETALLIC COMPOUNDS
PROTEINS
TERPENES
AQUIRE: Aquatic Toxicity Information Retrieval data base. Data file, 14:37275 (R;US)
Use of industrial-hygiene samplers for soil-gas measurement, 14:37221 (R;US)

ORGANIC PHOSPHORUS COMPOUNDS
See also PHOSPHINIC ACID ESTERS
PHOSPHONIC ACID ESTERS
PHOSPHORIC ACID ESTERS
TOPO
Acceptor extraction of uranyl salts with mixtures of organophosphoric acids with neutral additives, 14:36863 (RA;SU)
Application of eda interactions for explaining and forecasting the extractive ability of elementoorganic reagents, 14:36858 (RA;SU)
Electron structure and electrostatic potential of some neutral organophosphorus extractants and their complexes, 14:36818 (RA;SU)
Multifunctional organophosphorus extractants: a status report on development and applications, 14:35764 (RA;SU)
Prediction and control of extraction ability and some physicochemical properties of extractants (Solvent extraction of actinides and rare earths.), 14:36859 (RA;SU)

ORGANIC POLYMERS
See also POLYAMIDES
POLYESTERS
POLYETHYLENE GLYCOLS
RESINS
Chemistry and microstructure at metal-polymer interfaces, 14:36668 (BA;FR)

ORGANIC SULFUR COMPOUNDS
See also SULFONIC ACIDS
SULFOXIDES
THIOPHENE
Laser spectroscopy and dynamics of combustion intermediates: Three year progress report, 1 June 1986–31 May 1989, 14:36868 (R;US)

ORGANOMETALLIC COMPOUNDS
[Ligand intermediates in metalcatalyzed reactions]: Progress report, July 1, 1985–June 30, 1989, 14:36737 (R;US)

ORNL
Impacts of DOE Order 5820.2A on Oak Ridge National Laboratory, 14:37227 (R;US)
Using computer-based training to facilitate radiation protection review, 14:35824 (RA;US)

ORNL-PCA REACTOR
Bulk Shielding Facility quarterly report, January, February, and March 1989, 14:36125 (R;US)

ORSAY SYNCHROTRON
Decay of doubly-odd nucleus ^{184}Ir, 14:37594 (R;FR)
Selective population of the highest spin n-p states in heavy nuclei via the (α, d) reaction at 218 MeV, 14:37588 (R;FR)

ORTHOPTERA
Plant photosynthetic pathways and grazing by phytophagous orthopterans, 14:35919 (J;US)

OSCILLATIONS (PLASMA)
See PLASMA WAVES

OUTPUT
See PRODUCTION

OWNERSHIP
Energy privatisation, 14:36271 (R;GB)

OXALATES
On thorium and plutonium cocrystallization with calcium oxalate, 14:37356 (RA;SU;In Russian)

OXIDES
See also ALUMINIUM OXIDES
BARIUM OXIDES
BERYLLIUM OXIDES
BISMUTH OXIDES
CESIUM OXIDES
CHROMIUM OXIDES
COPPER OXIDES
DYSPROSIUM OXIDES
ERBIUM OXIDES
GADOLINIUM OXIDES
HAFNIUM OXIDES
HOLMIUM OXIDES
IRON OXIDES
LANTHANUM OXIDES
LEAD OXIDES
LITHIUM OXIDES
MAGNESIUM OXIDES
MANGANESE OXIDES
MOLYBDENUM OXIDES
NICKEL OXIDES
NIOBIUM OXIDES
NITROGEN OXIDES
PHOSPHORUS OXIDES
PLUTONIUM OXIDES
POTASSIUM OXIDES
RUTHENIUM OXIDES
SAMARIUM OXIDES
SILICON OXIDES
STRONTIUM OXIDES
SULFUR OXIDES
TANTALUM OXIDES
TELLURIUM OXIDES
TERBIUM OXIDES
THALLIUM OXIDES
TITANIUM OXIDES
TUNGSTEN OXIDES
VANADIUM OXIDES
YTTRIUM OXIDES
ZIRCONIUM OXIDES
A method of removing oxides from the surface of Fe-Ni-Co alloy particles by chemical etching, 14:36582 (R;US)
Composition and structure of the passive oxide film on iron as observed by second harmonic generation, 14:36650 (BA;US)
Properties of the new high T_c materials, 14:36654 (J;US)
Superconducting properties of magnetron sputtered high T_c thin films containing oxide compounds of yttrium, bismuth, or thallium, 14:36950 (J;US)
Understanding oxide-metal interfaces, 14:36620 (BA;FR)

OXOPROPANE
See ACETONE

OXYGEN
Charged particle activation analysis of light elements, 14:36721 (RA;JP;In Japanese)
Infrared study of carbon deposits on catalysts, 14:36736 (R;US)
Oxygen segregation in 32°[001] molybdenum tilt grain boundary. I. Segregation sites determination, 14:36502 (BA;FR)
Oxygen segregation in 32°[001] molybdenum tilt grain boundary. II. Enthalpies of segregation determination from AES and grain boundary grooves measurements, 14:36503 (BA;FR)

Results of fisheries investigations in Douglas tailwater, August 1987–September 1988, 14:35897 (R;US)

OXYGEN 16
Catalytic activity in reactions of isotopic exchange of carbon monoxide and adsorption properties of catalysts on zinc oxide base, 14:36815 (RA;SU;In Russian)

OXYGEN 16 BEAMS
Heavy ions reactions below 100 MeV per nucleon: two contributions to the study of subthreshold pion production, 14:37601 (R;FR;In French)

OXYGEN 16 REACTIONS
Multiple angular scattering of heavy ions $^{16-17}O$, ^{40}Ar, ^{86}Kr, ^{100}Mo at intermediate energies (20-90 MeV/u), 14:37682 (R;FR)

OXYGEN 16 TARGET
Measure of back angle cross sections of antiproton-nucleus elastic scattering at 48 and 180 MeV, 14:37577 (R;FR;In French)

OXYGEN 17 REACTIONS
Multiple angular scattering of heavy ions $^{16-17}O$, ^{40}Ar, ^{86}Kr, ^{100}Mo at intermediate energies (20-90 MeV/u), 14:37682 (R;FR)

OXYGEN 18
Catalytic activity in reactions of isotopic exchange of carbon monoxide and adsorption properties of catalysts on zinc oxide base, 14:36815 (RA;SU;In Russian)

OXYGEN 18 TARGET
Measure of back angle cross sections of antiproton-nucleus elastic scattering at 48 and 180 MeV, 14:37577 (R;FR;In French)

OXYGEN COMPOUNDS
See also CUPRATES
IODATES
MOLYBDATES
NIOBATES
NITRATES
OXIDES
SULFATES
VANADATES
WATER
Diffusion reactions between silicon oxynitride and silicon nitride during HIP-synthesis, 14:36625 (BA;FR)

OXYGEN EFFECT (RADIOBIOLOGY)
See OXYGEN

OXYGEN HYDRIDES
See WATER

OXYGEN IONS
Path-integral formulation of ion heating, 14:37450 (R;US)

OXYMETHYLENE
See FORMALDEHYDE

OYSTER CREEK-1 REACTOR
Team skills training: the critical next step at GPU Nuclear, 14:35985 (RA;US)

OZONE
Effects of air pollutants on the composition of stable carbon isotopes $\delta^{13}C$, of leaves and wood, and on leaf injury, 14:37396 (J;US)
Effects of ozone and simulated acid rain on mycorrhizal infection in two families of Pinus taeda L, 14:37336 (J;US)
Evaluating CFC [chlorofluorocarbon] alternatives from the atmospheric viewpoint: Revision 1, 14:37196 (R;US)
Guidance for the preparation of quality-assurance plans for O_3/CO SIP (State Implementation Plan) emission inventories. Final report, 14:37205 (R;US)
Ozone measurements near the ground and in the atmosphere in the first half-year 1988, 14:37170 (R;DE;In German)
Toxicology of ozone. April 1988-April 1989 (Citations from the NTIS data base). Report for April 1988-April 1989, 14:37394 (R;US)
Toxicology of ozone. January 1970-March 1988 (Citations from the NTIS data base). Report for January 1970-March 1988, 14:37393 (R;US)

P

P CODES
PRISIM - A computer program that enhances operational safety, 14:35983 (RA;XA)
The plant expert system (PLEXSYS) development environment: System description and user's manual, version 2: Final report, 14:36007 (R;US)
Two dimensional modeling of fluid mechanics, heat transfer, and NO decomposition in the CFFF radiant furnace, 14:36358 (BA;US)

P INVARIANCE
Parity violation workshop, 14:37502 (R;US)

PACIFIC GAS DIABLO CANYON-1 REACTOR
See DIABLO CANYON-1 REACTOR

PACIFIC GAS DIABLO CANYON-2 REACTOR
See DIABLO CANYON-2 REACTOR

PACKINGS
Fly ash/cement packing for Lingan Mine: final appraisal and trial proposal, 14:35561 (R;CA)

PADUCAH PLANT
Management of training counting beans or demonstrating results, 14:35828 (RA;US)

PAINTS
Characterization of painted surfaces in the United States from the perspective of potential damage from acidic deposition, 14:37163 (R;US)

PALLADIUM
Measurements of the elastic constants, the specific heat and the entropy of grain boundaries by means of ultra-fine grained materials, 14:36541 (BA;FR)
Some remarks on the neutron elastic- and enelastic-scattering cross sections of palladium, 14:37585 (R;US)

PALLADIUM ALLOYS
Subcritical crack growth in metal-ceramic-interfaces, 14:36986 (BA;FR)

PANAMA
Economics of selected energy applications of peat in Panama and Costa Rica, 14:35595 (R;US)

PAPER CHROMATOGRAPHY
See CHROMATOGRAPHY

PAPER INDUSTRY
Combustion research opportunities for industrial applications: Phase II, 14:36412 (R;US)
Proceedings of the workshop on aspen pulp, paper and chemicals, 14:35900 (R;CA)

PARABANIC ACID
See IMIDAZOLES

PARABOLIC DISH COLLECTORS
Progress in parabolic dish technology, 14:35930 (R;US)

PARABOLIC POINT COLLECTORS
See PARABOLIC DISH COLLECTORS

PARALLEL PROCESSING
CFD (computational fluid dynamics) research for minisupercomputers: a Yale/UTRC program. Final report, 15 February 1987-14 October 1988, 14:37478 (R;US)
Chaotic behavior in a new class of parallel optimization algorithms, 14:37799 (R;US)
Computational fluid dynamics (CFD): element-by-element analysis for advanced computers. Final report, 1 April 1987-14 November 1988, 14:37479 (R;US)
Developing software to use parallel processing effectively. Final report, June-December 1987, 14:37797 (R;US)
Expert systems on multiprocessor architectures. Phase 1. Final report, March 1985-July 1987, 14:37795 (R;US)
Parallel problem-solving system, PRISM (Parallel Inference System). Final report, November 1986-February 1988, 14:37796 (R;US)
Randomized parallel branch-and-bound algorithm, 14:37794 (R;US)

PARITY NONCONSERVATION
See P INVARIANCE

PARTHENOGENESIS
See REPRODUCTION

PARTICLE BEAM FUSION ACCELERATOR
See also ELECTRON BEAM FUSION ACCELERATOR
Status of light ion approach inertial confinement fusion, 14:37779 (R;US)
PARTICLE BOOSTERS
Superconducting booster project: [Final report], 14:37072 (R;US)
The beam tracking during the first few milliseconds of a low energy booster, 14:37048 (R;US)
PARTICLE IDENTIFICATION
Neural networks for event filtering at Dv, 14:37106 (R;US)
Neural networks, D0, and the SSC, 14:37104 (R;US)
Ring imaging Cherenkov detector. The DELPHI Barrel RICH Prototype. Part B: Experimental studies of the detector performance for particle identification, 14:37101 (R;FR)
PARTICLE INTERACTIONS
See also HADRON-HADRON INTERACTIONS
Ninth conference of Czechoslovak physicists. Part 1, 2, 14:37678 (R;CS;In Czech, Slovak)
PARTICLE SIZE
Hazards of explosives dusts, 14:37150 (R;US)
PARTICLE SIZE CLASSIFIERS
Energy conservation in the industrial minerals sector. Comminution - Phase 3. Activity 4: monitoring and control of a dry grinding circuit using a particle size analyzer and programmable controllers, 14:36411 (R;CA)
PARTICULATES
See also TOTAL SUSPENDED PARTICULATES
5-MW Toronto HALT [Hydrate Addition at Low Temperature] pilot plant testing: Test results: Part 1-A, 14:35958 (R;US)
Activation analysis of air particulate matter, 14:36720 (R;DE)
Health-hazard evaluation determination report No. 73-185-256, Electromotive-Division, GMC (Plant 2), Chicago, Illinois, 14:37186 (R;US)
National Performance Audit Program; ambient air audits of analytical proficiency, 1987, 14:37189 (R;US)
TRUPACT I filter development: Status report, 14:36883 (R;US)
PARTITION CHROMATOGRAPHY
See CHROMATOGRAPHY
PASSIVE SOLAR HEATING SYSTEMS
Integrated thermal storage in energy systems for Canadian low energy houses, 14:36383 (RA;CA;In English and French)
PBFA
See PARTICLE BEAM FUSION ACCELERATOR
PCA-ORNL REACTOR
See ORNL-PCA REACTOR
PCB
See CHLORINATED AROMATIC HYDROCARBONS
PEACH BOTTOM-3 REACTOR
Feature-enhanced-imaging field trials: Peach Bottom Unit 3: Interim report, Phase 2, 14:35992 (R;US)
PEARLITE
Metallurgical aspects of crack-tip failure processes, 14:36590 (BA;US)
PEAT
Central American resource studies, 14:36236 (R;US)
Economics of selected energy applications of peat in Panama and Costa Rica, 14:35595 (R;US)
PEATLANDS
See WETLANDS
PEBBLE BED REACTORS
GAVROSh program complex abstract, 14:36020 (RA;SU;In Russian)
Methods of power distribution determination using the signals from out-of-pile detectors, 14:36108 (RA;SU;In Russian)
On the accident behaviour of the HTR-100. A risk-oriented analysis, 14:36157 (R;DE;In German)
PEGMATITES
Mineralogy of bismutotanitalite from Northeastern. Brazil, 14:37210 (R;BR;In Portuguese)
PELLET INJECTION
Panel discussion: Progress and plans for magnetic fusion: Summary of comments on recent progress in fusion research at the Oak Ridge National Laboratory, 14:37716 (R;US)
PENETRATORS
Numerical analysis of designs to reduce the kinetic energy of Davis Gun pusher plates, 14:36889 (R;US)
PENTAERYTHRITOL TETRANITRATE
See PETN
2,4-PENTANEDIONE
See ACETYLACETONE
PEOPLE
See HUMAN POPULATIONS
PEOPLES REPUBLIC OF CHINA
See CHINA
PERIODIC SYSTEM
Periodic system of chemical elements: old and new developments, 14:36703 (R;FR)
PERIOSTEUM
See BONE TISSUES
PERMEABILITY
Reservoir water loss modeling and measurements at Fenton Hill, New Mexico, 14:35942 (R;US)
PERSONNEL
See also CONTRACTOR PERSONNEL
MEDICAL PERSONNEL
MINERS
PROFESSIONAL PERSONNEL
REACTOR OPERATORS
ASQC support of the quality profession in the utility industry - is it sufficient?, 14:36060 (RA;US)
Adult learning techniques in maintenance training, 14:35988 (RA;US)
Application of quality principles to training of QA audit personnel, 14:36059 (RA;US)
Changing organizational cultures - creating quality achievers through training and teamwork, 14:36136 (RA;US)
Computer based training state of the art systems, 14:35826 (RA;US)
Demonstrations of a real time personnel and material tracking system, 14:37791 (R;US)
Effective transition from panel board to CRT-based process control, 14:35776 (RA;US)
Evolution of technician and maintenance training, 14:36004 (RA;US)
Hygienic characteristic of working conditions and use of some evaluation methods of health of persons subjected to concomitant effect of industrial factors, 14:37655 (RA;SU;In Russian)
Indoctrination: using interactive video to teach attitudes and knowledge in general employee training, 14:35827 (RA;US)
Office of the Inspector General: Semiannual report, October 1, 1988–March 31, 1989, 14:37793 (R;US)
Performance based training for quality surveillance personnel, 14:36058 (RA;US)
Personnel development program (an enhancement to GET), 14:36138 (RA;US)
Relating quality at work to quality at home, 14:35755 (RA;US)
Role of environmental qualification training in nuclear plant maintenance, 14:36140 (RA;US)
Systematic problem solving process (SPSP) - root cause analysis that works, 14:36137 (RA;US)
Team maintenance as a result of team training, 14:36057 (RA;US)
Using computer-based training to facilitate radiation protection review, 14:35824 (RA;US)
PESTICIDES
Study on residues and degradation of ^{14}C-phoxim in spring wheat plants and soil, 14:37333 (R;CN;In Chinese)
[International workshop on terrestrial field testing of pesticide, Cambridge, United Kingdom, September 11–16, 1988]: Foreign trip report, 14:37335 (R;US)
PETN
Investigation of ambient and high temperature aging of PETN [pentaerythritol tetranitrate] by laser induced fluorescence and ultraviolet absorption spectroscopies, 14:37152 (R;US)
PETROLEUM
Absorption Spectroscopy
Laboratory investigation on the evaluation of crude oil concentration by spectroscopic methods, 14:35665 (R;CA)

Biodegradation
The thick-getting mechanism and characteristics of terrestrial heavy oil pools in China, 14:35599 (RA;CA)

Coprocessing
Improved performance in co-processing through fundamental and mechanistic studies in hydrogen transfer and catalysis: Quarterly report, December 27, 1988–March 27, 1989, 14:35526 (R;US)

Deasphalting
Angelov/Shibley process improves economics of processing heavy oil, 14:35639 (RA;CA)

Energy Consumption
Annual outlook for oil and gas 1989, 14:35652 (R;US)

Energy Supplies
Annual outlook for oil and gas 1989, 14:35652 (R;US)
Petroleum supply monthly, April 1989: Final 1988 statistics in summary section, 14:35650 (R;US)
Petroleum supply monthly, March 1989, 14:35649 (R;US)

Enhanced Recovery
Cyclic CO_2 injection for light oil recovery: Performance of a cost shared field test in Louisiana: Second quarterly report, 21 February–21 May 1989, 14:35632 (R;US)
Enhanced oil recovery program plan: FY 1989, 14:35633 (R;US)

Exploration
International oil and gas exploration and development activities: Quarterly report, First quarter 1989, 14:35601 (R;US)

Forecasting
Annual outlook for oil and gas 1989, 14:35652 (R;US)

Hydrocracking
Mild resid hydrocracking for heavy oil upgrading, 14:35637 (RA;CA)

Market
Heavy oil. Markets in the 90's. How do they look?, 14:35647 (R;CA)
Update: Refiners' and marketers' perspectives. What the crash of 1986 did to heavy crude economics and marketing, 14:35646 (RA;CA)

Meetings
Challenges and innovations 1989. 6th Annual heavy oil and oil sands technical symposium, 14:35691 (R;CA)
UNITAR/UNDP, 4th international conference on heavy crude and tar sands, vol. 2, 14:35689 (R;CA)

Prices
Assumptions for the annual energy outlook 1989, 14:36256 (R;US)

Production
Petroleum supply annual 1988: Volume 1, 14:35651 (R;US)

Pumping
New solutions to oil problems in pumping heavy oil, 14:35620 (RA;CA)

Refining
ASVAHL new routes for prosessing heavy oils, 14:35636 (RA;CA)

Supply and Demand
Canadian energy supply and demand, 1987-2005, 14:36259 (R;CA)
Canadian energy supply and demand, 1987-2005, 14:36260 (R;CA;In French)

Thermal Cracking
Use of small scale ART processing for wellhead viscosity reduction and upgrading of heavy oils, 14:35712 (RA;CA)

Uses
Oil use and oil dependency: Long-term issues, 14:35654 (R;US)

Vapor Pressure
Improved techniques for measuring heavy crude oil vapor pressures for monitoring tank emissions, 14:35663 (RA;CA)

Viscosity
The thick-getting mechanism and characteristics of terrestrial heavy oil pools in China, 14:35599 (RA;CA)

PETROLEUM COKE
See PETROLEUM PRODUCTS

PETROLEUM DEPOSITS
See also NAVAL PETROLEUM RESERVE
OIL FIELDS
Characterization and implications of dickite-mineralized fractures in Mesaverde core from Piceance Creek basin, 14:35673 (J;US)
Design and evaluation of pilot tests of steam soak with additives in Venezuela heavy oil reservoirs, 14:35607 (RA;CA)
Estreito field study of reservoir for the extension of steam cyclic injection pilot projects, 14:35614 (RA;CA)
Experimental design for non-equilibrium immiscible carbon dioxide flood, 14:35603 (RA;CA)
Feasibility of steam injection at 8200 feet, 14:35617 (RA;CA)
Formation and development of deposits in salt strata. Final report, 14:35598 (R;DE;In German)
New technologies in termalrecovery contribution of horizontal wells, 14:35611 (RA;CA)
Performance of first and second pilot cyclic steam stimulation projects in Kuwait, 14:35612 (RA;CA)
Steam stimulation experience in Lake Maracaibo, 14:35616 (RA;CA)
Tectonism, subsidence, and fracturing of Mesaverde reservoirs in the Piceance basin, Colorado, 14:35602 (J;US)
The Jobo Steamflood Project: A preliminary evaluation of results, 14:35615 (RA;CA)
The effects of well completion, steam injection and production practices on heavy oil production performance, 14:35613 (RA;CA)
Use of slant drilling techniques for exploitation of Venezuela's shallow reservoir, 14:35606 (RA;CA)

PETROLEUM INDUSTRY
A guide to socio-economic impact monitoring in the Northwest Territories, 14:37283 (R;CA)
Combustion research opportunities for industrial applications: Phase II, 14:36412 (R;US)
Comparative economic analysis of heavy oil recovery projects in China and Canada, 14:35645 (RA;CA)
Legal framework for operation of government research and development agencies, 14:35690 (RA;CA)
Monthly energy review, March 1989, 14:35648 (R;US)

PETROLEUM PRODUCTS
See also DIESEL FUELS
FUEL OILS
GASOLINE
International petroleum statistics report, 14:35653 (R;US)
Petroleum supply annual 1988: Volume 1, 14:35651 (R;US)
Petroleum supply monthly, April 1989: Final 1988 statistics in summary section, 14:35650 (R;US)
Petroleum supply monthly, March 1989, 14:35649 (R;US)

PETROLEUM REFINERIES
Low severity co-processing using homogeneous basic nitrogen promotors, 14:35641 (J;US)
OSLO project update and upgrader technology selection, 14:35729 (RA;CA)
Petroleum supply annual 1988: Volume 1, 14:35651 (R;US)
Refinery yield model spreadsheet system (RYMSS) documentation, 14:35640 (R;US)
Syncrude processing in conventional refineries, 14:35704 (RA;CA)

PETROLEUM RESIDUES
A fundamental research program in coal/heavy oil coprocessing and heavy oil processing: Final report, 14:35523 (R;US)
Coal/oil coprocessing mechanism studies, 14:35546 (J;US)
Coking of oil sand, asphaltenes and residual oils in the LR-process, 14:35705 (RA;CA)
Low severity co-processing using homogeneous basic nitrogen promotors, 14:35641 (J;US)
Reaction mechanism in VisABC process, 14:35635 (RA;CA)

PETROLEUM STOCKS
See INVENTORIES

PH VALUE
High-temperature optical-fiber pH sensor: Final report, 14:36848 (R;US)

PHANTOMS
[Biospheric model validation in urban, terrestrial, and aquatic environments, Budapest, Hungary, Vienna, Austria, Neuherberg, and Schmallenberg, W. Germany, April 25–May 12, 1988]: Foreign trip report, 14:37661 (R;US)
PHENOLS
Explorations of mechanisms regulating ectomycorrhizal colonization of boron-fertilized pine: Quarterly report, April 1,1989–June 30, 1989, 14:35901 (R;US)
Micelle formation during extraction of alkali elements from strongly alkaline mediums (Alkali elements: Cs, Rb, K.), 14:36822 (RA;SU)
Thermal stability of jet fuel: Second quarterly report, January–March 1989, 14:35643 (R;US)
PHENYLETHYLENE
See STYRENE
PHOSPHINIC ACID ESTERS
Extraction of zinc(2), cadmium(2), copper(2) and iron(3) by cyanex 272, 14:36840 (RA;SU)
PHOSPHONIC ACID ESTERS
Studies of the influence of different anions on extraction of neodymium with di(1-methylheptyl)methyl phosphonate, 14:36826 (RA;SU)
PHOSPHORIC ACID
Separation potential of solvent extraction in the recovery of metals, 14:35762 (BA;US)
PHOSPHORIC ACID ESTERS
See also HDEHP
Regularities of the extraction of rare earth elements with triisoamyl phosphate, 14:36842 (RA;SU)
Some regularities of extraction of rare earth elements by organophosphoric acid, 14:36843 (RA;SU)
PHOSPHORUS
EBIC and DLTS measurements of SI- and polycrystalline silicon, 14:36673 (BA;FR)
Effect of manganese on intergranular fracture in low alloy steels, 14:36537 (BA;FR)
Grain boundary electrical activity of n-type germanium, 14:36532 (BA;FR)
Segregation energies of phosphorus and sulfur in various relaxed structures of grain boundaries in Ni by tight-binding approximation, 14:36509 (BA;FR)
PHOSPHORUS COMPOUNDS
See also PHOSPHORUS OXIDES
The nature and composition of the passive film formed on Ni-P-Cr metallic glasses, 14:36366 (BA;US)
PHOSPHORUS OXIDES
Laboratory testing of a fluidized-bed dry-scrubbing process for the removal of acidic gases from a simulated incinerator flue gas: Final report, 14:36416 (R;US)
PHOTOACOUSTIC SPECTROSCOPY
Background correction in photothermal deflection spectroscopy using a single position sensor, 14:36850 (BA;US)
PHOTOCHEMISTRY
Evaluating CFC [chlorofluorocarbon] alternatives from the atmospheric viewpoint: Revision 1, 14:37196 (R;US)
PHOTOIONIZATION
Multiphoton ionization of $(Xe)_n$ and $(NO)_n$ clusters using a picosecond laser, 14:37464 (R;US)
PHOTOMAGNETIC EFFECT
See VISIBLE RADIATION
PHOTOMAGNETOELECTRIC EFFECT
See MAGNETIC FIELDS
PHOTON ACTIVATION ANALYSIS
See ACTIVATION ANALYSIS
PHOTONS
PHOTON-NUCLEON INTERACTIONS
Direct photon and π^0 production by deep inelastic scattering of real photons inclusive and exclusive studies, 14:37547 (R;FR;In French)
PHOTONS
Direct photon and π^0 production by deep inelastic scattering of real photons inclusive and exclusive studies, 14:37547 (R;FR;In French)
Three and five photon decays of the J/PSI (3097), 14:37553 (R;FR)
PHOTOPRODUCTION
Tests of QCD in photoproduction, 14:37543 (R;FR)
PHOTOSENSITIVITY
Electron impact fragmentation study of compounds from colour photosensible materials, 14:37469 (RA;RO;In Romanian)
PHOTOSPHERE
Temporal variations of solar-spectral-line profiles induced by the 5-minute photospheric oscillation, 14:37422 (R;US)
PHOTOVOLTAIC CONVERSION
Photovoltaics advanced research and development: 9th annual review meeting, 14:35908 (R;US)
PHOTOVOLTAIC POWER PLANTS
Research in photovoltaics, 14:36342 (RA;US)
Status of photovoltaics for commercial power generation, 14:36343 (RA;US)
PHYSICAL PROTECTION
The ASSESS Neutralization Analysis module, 14:35848 (R;US)
The assess facility descriptor module, 14:35847 (R;US)
PHYSICAL PROTECTION DEVICES
TRACE - Tamper Resistant Authenticated Camera Enclosure, 14:36890 (R;US)
PHYSICAL RADIATION EFFECTS
Post-irradiation fracture toughness characterization of four lab-melt plates: Revision 1, 14:36578 (R;US)
PHYSICS
See also ATOMIC PHYSICS
HIGH ENERGY PHYSICS
NUCLEAR PHYSICS
REACTOR PHYSICS
SOLID STATE PHYSICS
Advances in Physics, 14:37418 (R;RO;In Rumanian)
Experimental and theoretical physics, 14:37420 (R;SU;In Russian)
Physical experiment technique. Scientific-technical collection, 14:37419 (R;SU;In Russian)
PI-1016 RESONANCES
See MESONS
PICEANCE CREEK BASIN
Characterization and implications of dickite-mineralized fractures in Mesaverde core from Piceance Creek basin, 14:35673 (J;US)
Tectonism, subsidence, and fracturing of Mesaverde reservoirs in the Piceance basin, Colorado, 14:35602 (J;US)
PIGE ANALYSIS
See PROTON REACTIONS
PIGMENT CELLS
See ANIMAL CELLS
PINES
Measurement of SO_2 uptake and redistribution of sulfur in a pine canopy using ^{35}S, 14:35921 (J;US)
PINS (FUEL)
See FUEL PINS
PION MINUS REACTIONS
Cumulative π^- production in 4.5 AGeV/c He induced reactions, 14:37519 (RA;RO;In Romanian)
PION REACTIONS
See also PION MINUS REACTIONS
Medium energy meson physics: [Progress report, 1981–1983], 14:37564 (R;US)
PION-NUCLEON INTERACTIONS
Three-body unitarity, the cloudy bag model, and the Roper resonance, 14:37537 (J;US)
PIONS
See also PIONS NEUTRAL
Medium energy meson physics: [Progress report, 1981–1983], 14:37564 (R;US)
PIONS NEUTRAL
Direct photon and π^0 production by deep inelastic scattering of real photons inclusive and exclusive studies, 14:37547 (R;FR;In French)

PIPE JOINTS
Investigation of a premium casing connection for Canadian thermal recovery wells, 14:35627 (RA;CA)

PIPE RESTRAINTS
See RESTRAINTS

PIPELINES
A guide to socio-economic impact monitoring in the Northwest Territories, 14:37283 (R;CA)
Applications by Phillips Petroleum Resources, Ltd. for permits to construct pipelines to transport sour gas and fuel gas in the salter field, 14:35683 (R;CA)
Calculational method for individual pipeline tracing in channel nuclear reactors, 14:36018 (RA;SU;In Russian)
Reasons for descisions-TransCanada Pipelines Ltd. Requests pertaining to the installation and to the approval of the method of devising rights and of the connected questions about rates, 14:35682 (R;CA;In French)
Threshold-stress determination using tapered specimens and cyclic stresses, 14:35685 (BA;US)

PIPES
See also DRILL PIPES
A review of recent developments in pipe damping allowable values for United States nuclear plants, 14:35990 (R;US)
Aging degradation of BWR feedwater and main steam lines, 14:35989 (R;US)
Comparison of analysis and vibration test results for a multiple supported piping system, 14:36143 (R;US)
Crack growth behavior and modeling: Topical report, 14:36466 (R;US)

PITTING CORROSION
The influence of surface capacitance on the measurements of localized corrosion transients, 14:36368 (BA;US)

PITTSBURGH ENERGY TECHNOLOGY CENTER
Evaluation of an on-line gas chromatographic system, 14:35545 (BA;US)

PLANKTON
Plankton studies at Sequoyah Nuclear Plant in 1988, 14:36111 (R;US)

PLANT GROWTH
[Workshop on global vegetation models, Laxenburg, Austria, 3 June–9 August 1988]: Foreign trip report, 14:37174 (R;US)

PLANTS
See also ALGAE
FUNGI
HERBS
SHRUBS
TREES
VEGETABLES
Absorption, distribution, and fate of neptunium in plants, 14:37233 (J;US)
Long-term recovery of northern hardwood forest following gamma irradiation, 14:37337 (J;US)
Priorities for the next decade of research in radiation ecology, 14:37385 (J;US)
The role of heterogeneity in structuring spatial hierarchies, 14:37212 (J;US)

PLANTS (INDUSTRIAL)
See INDUSTRIAL PLANTS

PLASMA
See also COLLISIONAL PLASMA
HIGH-BETA PLASMA
HOT PLASMA
INHOMOGENEOUS PLASMA
LASER-PRODUCED PLASMA
A heat-driven monochromatic light source, 14:37751 (J;US)
Atomic physics studies of highly charged ions on tokamaks using x-ray spectroscopy, 14:37738 (R;US)
Ionization equilibrium in dense plasmas, 14:37748 (D;US)
Magnetohydrodynamic clump instability, 14:37713 (R;US)
Two-dimensional effects in hollow core Z-pinches, 14:37743 (R;US)
Two-dimensional effects in imploding plasma liners, 14:37742 (R;US)

PLASMA ACCELERATION
Boundary treatment of the diffusion synthetic acceleration method for fixed-source discrete-ordinates problems in x-y geometry, 14:36081 (J;US)

PLASMA ACCELERATORS
See PLASMA GUNS

PLASMA CONFINEMENT
A computer model of the ZTH energy system at Los Alamos, 14:37749 (J;US)
Spatial structure of transient plasmas revealed with a CCD camera, 14:37746 (BA;US)

PLASMA DENSITY
The dynamics of charged particles in the near wake of a very negatively charged body, 14:37785 (J;US)

PLASMA DIAGNOSTICS
Large coil task instrumentation and diagnostics, 14:36929 (J;US)
On the ion temperature measurement by the CO_2-laser radiation scattering in tokamaks, 14:37726 (RA;SU;In Russian)
Probe measurements in the gas descharge plasma of a negative hydrogen ion source, 14:37768 (RA;SU;In Russian)
X-ray absorption spectroscopy of laser-produced plasmas: A study of the experiment and data analysis, 14:37752 (J;US)

PLASMA DIODES
See THERMIONIC DIODES

PLASMA DRIFT
Electron-density profiles and plasma-drift measurements with digital ionosondes. Technical report, July 1987-June 1988, 14:37452 (R;US)

PLASMA EXPANSION
Magnetic field-aligned plasma expansion in critical ionization velocity space experiments, 14:37459 (J;US)

PLASMA GUNS
Novel methods of acceleration. Final report, 30 September 1983-29 September 1988, 14:37067 (R;US)

PLASMA INSTABILITY
An overview of atomic and molecular processes in critical velocity ionization, 14:37750 (J;US)
Magnetohydrodynamic clump instability, 14:37713 (R;US)

PLASMA OSCILLATIONS
See PLASMA WAVES

PLASMA SHEATH
Dynamics of a collisional, capacitive RF sheath, 14:37753 (J;US)

PLASMA SIMULATION
Axisymmetric particle-in-cell simulations of diamagnetic-cavity formation in vacuum, 14:37784 (J;US)
Spacecraft charging potential during electron-beam injections into space plasmas, 14:37783 (J;US)

PLASMA SWITCHES
Calculational evaluation of plasma flow switches for the Los Alamos Foil Implosion Project, 14:37003 (R;US)
Interstage closure times for the rimfire multistage gas switch, 14:37773 (R;US)
Numerical analysis of experimental data to infer plasma opening switches, 14:37016 (R;US)
Numerical simulation of plasma opening switches, 14:37806 (R;US)
Performance of plasma opening switches for the Particle Beam Fusion Accelerator II (PBFA II), 14:37774 (R;US)
Plasma circuit breaker in a magnetic field as a high-power ion flux generator, 14:37767 (RA;SU;In Russian)
Plasma flow switch characterization for the Los Alamos Foil Implosion Project, 14:37012 (R;US)

PLASMA WAVES
An overview of atomic and molecular processes in critical velocity ionization, 14:37750 (J;US)
Caviton dynamics in strong Langmuir turbulence, 14:37457 (R;US)
Theoretical modeling of plasma waves in the magnetosphere. Final report, 1 October 1982-30 September 1988, 14:37451 (R;US)

PLASMOIDS
Parallel electric fields in a simulation of magnetotail reconnection and plasmoid evolution, 14:37455 (R;US)

PLASTICS
The effective utilization of differential scanning calorimetry (DSC) to assess molded parts, 14:36678 (R;US)
PLATINUM
Infrared study of carbon deposits on catalysts, 14:36736 (R;US)
PLATINUM ALLOYS
Optical properties of metals and alloys: Au, Ag, FeRh, $AuAl_2$, and $PtAl_2$, 14:36604 (D;US)
PLATINUM ISOTOPES
Shape transition in neutron deficient PT isotopes, 14:37592 (R;FR)
PLESIOTHERAPY
See RADIOTHERAPY
PLUGGING
Reservoir plugging/blocking using ultramicrobacteria: Three-dimensional physical simulator results, 14:35707 (RA;CA)
PLUNGER PUMPS
See ROD PUMPS
PLUTONIUM
Developments in the TEM examination of Pu and Pu alloys, 14:36598 (BA;US)
Electrorefining cell evaluation, 14:35758 (R;US)
Experimental facilities for pyrochemical development at the Savannah River Site, 14:35817 (R;US)
Implementation of isotope correlation technique for safeguards, 14:35836 (R;US)
Separation potential of solvent extraction in the recovery of metals, 14:35762 (BA;US)
[Analytical chemistry in nuclear technology, Karlsruhe, Germany and visit to Seibersdorf, Austria, June 3–22, 1989]: Foreign trip report, 14:35766 (R;US)
PLUTONIUM 239
Effect of change in diet on excretion of plutonium-239 from organism, 14:37365 (RA;SU;In Russian)
On the effect of iron on plutonium metabolic mechanism in liver tissue, 14:37363 (RA;SU;In Russian)
PLUTONIUM ALLOYS
Developments in the TEM examination of Pu and Pu alloys, 14:36598 (BA;US)
PLUTONIUM COMPLEXES
Extraction properties of TBP - uranyl nitrate disolvate, 14:36718 (RA;SU)
PLUTONIUM COMPOUNDS
See also PLUTONIUM OXIDES
On thorium and plutonium cocrystallization with calcium oxalate, 14:37356 (RA;SU;In Russian)
PLUTONIUM OXIDES
Compressive creep in nuclear oxides, 14:36614 (R;GB)
POINT BEACH-1 REACTOR
Expectations for training, 14:36002 (RA;US)
POINT BEACH-2 REACTOR
Expectations for training, 14:36002 (RA;US)
POINT MUTATIONS
See GENE MUTATIONS
POISEUILLE FLOW
See LAMINAR FLOW
POISONS (CHEMICAL)
See HAZARDOUS MATERIALS
POLAND
Radon concentrations in air of Polish underground coal mines, 14:35597 (RA;CA)
POLAR-CAP AURORAE
Investigations of auroral dynamics: techniques and results, 14:37453 (R;SE)
Scientific results from the Swedish Viking satellite: A 1988 status report, 14:37454 (R;SE)
POLARIZED BEAMS
Program for calculating parameters of atomic beam of polarized particle source and jet polarized targets on 'Pravets-16', 14:37086 (R;SU;In Russian)
POLARIZED TARGETS
Program for calculating parameters of atomic beam of polarized particle source and jet polarized targets on 'Pravets-16', 14:37086 (R;SU;In Russian)
POLARONS
Formation, motion and high temperature superconductivity of large bipolarons, 14:37698 (R;US)
POLLUTION
See also AIR POLLUTION
LAND POLLUTION
WATER POLLUTION
Mitigation studies, 14:37246 (RA;NO)
POLLUTION REGULATIONS
Cost impact of potential RCRA (Resource Conservation Recovery Act) changes on New York State Utility coal-waste disposal. Final report, 14:35563 (R;US)
POLLUTION SOURCES
See also MOBILE POLLUTANT SOURCES
STATIONARY POLLUTANT SOURCES
An application of SPANS technology to toxic contaminant monitoring in the Atlantic region, 14:37219 (R;CA)
Trajectory analysis of nine years of precipitation chemistry in Charlottesville, Virginia: Final report, 14:37165 (R;US)
POLONIUM 210
^{210}Po incorporation to the structure of sulfurcontaining aminoacids, 14:37364 (RA;SU;In Russian)
Modeling of combined effect of alcohol, tobacco smokes and internal irradiation of laboratory animals, 14:37375 (RA;SU;In Russian)
POLY(ISOBUTYLENE OXIDE)
See ORGANIC POLYMERS
POLY(VINYLIDENE FLUORIDE)
See FLUORINATED ALIPHATIC HYDROCARBONS
POLYACRYLATES
Long-term degradation of dilute polyacrylamide solutions in turbulent pipe flow, 14:36422 (R;US)
POLYACRYLONITRILE
See ORGANIC POLYMERS
POLYAMIDES
Development of a membrane SO_x/NO_x treatment system: Final report, 28 April 1987–28 April 1988, 14:35957 (R;US)
POLYCARBONATES
Configurational diffusion of coal macromolecules: Quarterly progress report, March 16–June 15, 1989, 14:35556 (R;US)
POLYCRYSTALS
See also BICRYSTALS
Grain boundary design for desirable mechanical properties, 14:37674 (BA;FR)
POLYENES
Chemistry of bimetallic linked cyclopentadienyl complexes: Progress report, 1 December 1986–30 November 1989, 14:36738 (R;US)
POLYESTERS
Health-hazard evaluation determination report No. 75-178-295, New York Telephone and Telegraph Company, 770 Broadway, New York, New York, 14:37183 (R;US)
POLYETHERS
See POLYETHYLENE GLYCOLS
POLYETHYLENE GLYCOLS
Ionizable polyethers as specific metal ion carriers in liquid-liquid extraction and liquid membrane separations (Metals: Li-Cs, Ca, Sr, Ba.), 14:36834 (RA;SU)
New bis(grown ether)s as extraction agents, 14:36832 (RA;SU)
Prediction and control of extraction ability and some physicochemical properties of extractants (Solvent extraction of actinides and rare earths.), 14:36859 (RA;SU)
Size-selective extraction of metal salts: the general principles (Metals: alkali, alkaline earth, rare earth, transition elements, actinides.), 14:36831 (RA;SU)
Synergic extraction of metals with 4-acylpyrazol-5-ones and grown ethers, 14:36833 (RA;SU)
POLYETHYLENE OXIDES
See POLYETHYLENE GLYCOLS
POLYETHYLENE TERPHTHALATE
See POLYESTERS
POLYETHYLENES
A study of the use of crosslinked high-density polyethylene for low-level radioactive waste containers, 14:35794 (R;US)

POLYMERS
See also ORGANIC POLYMERS
Development of a thin wall graphite/polyimide composite pressure vessel with a large aspect ratio, 14:36884 (R;US)
Full-pattern refinement of crystalline polymer fibers based on diffractometer measurements, 14:36664 (R;US)
Methods for studying effects of high-energy irradiation on the mechanical and electric properties of polymers, 14:36655 (R;TR)
Scattering, deformation, and fracture in polymers, 14:36680 (B;US)

POLYNOMIALS
A MACSYMA package for the generation and manipulation of Chebyshev series, 14:37813 (R;US)

POLYPROPYLENE
Interfaces in composites reinforced with rapidly solidified metallic ribbons, 14:36495 (BA;FR)

POLYSULFIDES
See SULFIDES

POLYTETRAOXANE
See ORGANIC POLYMERS

POLYTHENE
See POLYETHYLENES

POLYTHIONATES
See OXYGEN COMPOUNDS
SULFUR COMPOUNDS

POLYTHIONIC ACIDS
See OXYGEN COMPOUNDS
SULFUR COMPOUNDS

POOL CRITICAL ASSEMBLY ORNL
See ORNL-PCA REACTOR

POPULATION DYNAMICS
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic): Blue crab, 14:37249 (R;US)

PORTSMOUTH GASEOUS DIFFUSION PLANT
Long-range health and safety management plan, fiscal years 1989–1995, 14:35842 (R;US)

POSITRONS
Implementation of computer programmes for fitting of positron annihilation spectra on "personal computers". Final report for the period 1 May 1986 - 14 June 1988, 14:37468 (R;XA)

POSTULATED PARTICLES
See also HEAVY LEPTONS
HIGGS BOSONS
QUARKS
Search for resonant Bhabha scattering at MeV energies, 14:37507 (R;DE)

POTASSIUM ALLOYS
Comparative analysis of rubidium, cesium-potassium, sodium state diagrams using photometry, 14:36549 (RA;SU;In Russian)

POTASSIUM COMPLEXES
Optical reflectance studies of $C_{24}K$ and $C_{24}K(NH_3)$, 14:36696 (BA;US)

POTASSIUM COMPOUNDS
See also POTASSIUM IODIDES
POTASSIUM OXIDES
POTASSIUM SULFATES
Barium potassium bismuth oxide: Synthesis and physical properties, 14:36639 (R;US)

POTASSIUM IODIDES
Fusion phase diagram of the system BiI_3-KI, 14:36797 (RA;SU;In Russian)

POTASSIUM OXIDES
Evidence for phonon-mediated coupling in superconducting $Ba_{0.6}K_{0.4}BiO_3$, 14:36615 (R;US)
Hetero- and homo-phase boundaries in ceramic oxides, 14:36626 (BA;FR)

POTASSIUM SULFATES
Coal ash deposition, interaction with metal substrates and deposit build up: Summary report, 26 February 1989–25 May 1989, 14:35586 (R;US)

POWDERS
Grain size control in powder processed $Y_1Ba_2Cu_3O_x$, 14:36947 (J;US)
Modeling of non-structural contribution to the pattern, 14:37685 (R;US)
Preparation of zeolites for TEM using microtomy, 14:36688 (BA;US)
The preparation of mechanically alloyed powders for TEM examination, 14:36596 (BA;US)

POWER DISTRIBUTION SYSTEMS
A planning model for electrical power distribution grids, 14:35973 (R;CA;In French)

POWER POOLS
See INTERCONNECTED POWER SYSTEMS

POWER REACTORS
See also BELLEFONTE-1 REACTOR
BELLEFONTE-2 REACTOR
BROWNS FERRY-1 REACTOR
BROWNS FERRY-2 REACTOR
BROWNS FERRY-3 REACTOR
CATAWBA-1 REACTOR
CATAWBA-2 REACTOR
CHERNOBYLSK-4 REACTOR
DIABLO CANYON-1 REACTOR
DIABLO CANYON-2 REACTOR
DUANE ARNOLD-1 REACTOR
LUCIE-1 REACTOR
LUCIE-2 REACTOR
MC GUIRE-1 REACTOR
MC GUIRE-2 REACTOR
OCONEE-1 REACTOR
OCONEE-2 REACTOR
OCONEE-3 REACTOR
OYSTER CREEK-1 REACTOR
PEACH BOTTOM-3 REACTOR
POINT BEACH-1 REACTOR
POINT BEACH-2 REACTOR
SEABROOK-1 REACTOR
SEABROOK-2 REACTOR
SEQUOYAH-1 REACTOR
SEQUOYAH-2 REACTOR
SHIPPINGPORT REACTOR
SOUTH TEXAS PROJECT-1 REACTOR
SOUTH TEXAS PROJECT-2 REACTOR
SURRY-1 REACTOR
SURRY-2 REACTOR
SUSQUEHANNA-1 REACTOR
SUSQUEHANNA-2 REACTOR
THREE MILE ISLAND-1 REACTOR
THREE MILE ISLAND-2 REACTOR
VERMONT YANKEE REACTOR
WATERFORD-3 REACTOR
WATTS BAR-1 REACTOR
WATTS BAR-2 REACTOR
Cracking and rupture of a prestressed reinforced concrete high-pressure vessel, 14:36090 (RA;SU;In Russian)
International co-operation in the field of operational safety, 14:36130 (R;FR)
Systems with aftereffect in nuclear reactor dynamics, 14:36070 (RA;SU;In Russian)

POWER SUPPLIES
See also SPACECRAFT POWER SUPPLIES
DIII-D power supply fault system, 14:37761 (R;US)
Standard terminal panel and UPS [uninterruptible power supply] design for exterior intrusion detectors and data collection applications, 14:37018 (R;US)

POWER TRANSMISSION LINES
On the limitation of the weak-coupling assumption for crosstalk analysis in an inhomogeneous medium, 14:35975 (R;US)
Study of electric field and ion effects of HVDC [high voltage direct current] transmission lines: Characterization of the electrical environment beyond the corridor: Final report, 14:35969 (R;US)
TV interference study on distribution test line, 14:35974 (R;CA)

POWERED SUPPORTS
Improvement of work safety and strain reduction when equipping thin faces through the development and testing of a turning and swinging installation for shield support units. Final report, 14:35596 (R;DE;In German)

PRASEODYMIUM COMPLEXES
Determination of thermodynamic characteristics of extraction equilibria in the systems containing ammonium salts and organic phosphorus compounds (Solvent extraction of nitrates of Ce, Pr, Eu, UO_2^{2+}, Th.), 14:36717 (RA;SU)

PRASEODYMIUM SULFATES
Interaction of cesium, nickel and praseodymium (3) sulfates in aqueous solutions, 14:36780 (RA;SU;In Russian)

PRECIPITATIONS (ATMOSPHERIC)
See ATMOSPHERIC PRECIPITATIONS

PRESERVATIVES
A field evaluation of four wood pole groundline preservative formulations using western Canadian wood species, 14:36674 (R;CA)

PRESSURE VESSELS
A structural evaluation of the Shippingport reactor pressure vessel for transport impact conditions, 14:36014 (R;US)
Cracking and rupture of a prestressed reinforced concrete high-pressure vessel, 14:36090 (RA;SU;In Russian)
Development of a thin wall graphite/polyimide composite pressure vessel with a large aspect ratio, 14:36884 (R;US)
Mission survey for the Pressure Vessel Research User's Facility (PVRUF), 14:36011 (R;US)
Shippingport Station Decommissioning Project preparation of the reactor pressure vessel: Topical report, 14:35784 (R;US)
Strain to failure of pressurized thick wall cylinders, 14:36995 (R;US)

PRESSURIZED WATER COOLED MODERATED REACTOR
See PWR TYPE REACTORS

PRESSURIZED WATER REACTORS
See PWR TYPE REACTORS

PRIMARY COOLANT CIRCUITS
Development of HPLC techniques for the analysis of trace-metal species in the primary coolant of a pressurized-water reactor, 14:36015 (D;GB)
Evaluation of SCC test methods for Inconel 600 in low-temperature aqueous solutions, 14:36175 (BA;US)
Reinforced confinement in a nuclear reactor, 14:36012 (TG;US)
Vibration monitoring of main coolant pumps: Guideline and reference data: Final report, 14:36096 (R;US)

PRINTED CIRCUITS
LineCAP [Line/Circuit Analysis Program]: Cross-coupling on PC [printed circuit] board traces including discontinuities and circuit elements, 14:37015 (R;US)

PROCESS CONTROL
Bristol Babcock DPC 3330 controller evaluation, 14:36417 (R;US)

PROCESS HEAT
Gas-based iron making: feasibility study. Final report, April 1985-December 1986, 14:36419 (R;US)

PROCESSING (DATA)
See DATA PROCESSING

PRODUCTION
Unattended mode operation of specialized NDA [nondestructive assay] systems, 14:35756 (R;US)

PRODUCTION (BEAM)
See BEAM PRODUCTION

PRODUCTION (ISOTOPE)
See ISOTOPE PRODUCTION

PRODUCTION REACTORS
Life extension approach to the reactor vessel of a nuclear production reactor: Revision 1, 14:36126 (R;US)

PROFESSIONAL PERSONNEL
Crisis management program for senior officials, 14:35830 (RA;US)
Developing a systematic approach to team training for emergency response personnel, 14:36135 (RA;US)
Expectations for training, 14:36002 (RA;US)

PROGRAMMING
See also PARALLEL PROCESSING
VECTOR PROCESSING
Computer software configuration management, 14:36098 (R;CA)

PROLIFERATION
Impact upon US security of a South African nuclear-weapons capability. Final technical report, 14:36458 (R;US)

2-PROPANOL
See PROPANOLS

1-PROPANOL
See PROPANOLS

PROPANOLS
Separation of low molecular weight alcohols from dilute aqueous solutions by reversible chemical complexation, 14:36725 (R;US)

PROPANONE
See ACETONE

PROPELLANTS
Nonlinear dynamic response of pressurized composite bottles subjected to shock loading, 14:36885 (R;US)

PROPER MOTION
Precise proper-motion measurement of solar granulation, 14:37421 (R;US)

PROPYL ALCOHOLS
See PROPANOLS

PROTECTION
See SAFETY

PROTECTION (RADIATION)
See RADIATION PROTECTION

PROTECTIVE COATINGS
Effect of Y_2O_3 additions on the plasticity of sintered Cr_2O_3, 14:36607 (J;US)
Health-hazard evaluation determination report No. 75-178-295, New York Telephone and Telegraph Company, 770 Broadway, New York, New York, 14:37183 (R;US)

PROTEINS
See also CYTOCHROMES
METALLOPROTEINS
Electrospray ionization-mass spectrometry and tandem mass spectrometry, 14:36846 (R;US)
Inducible cellular responses to DNA damage, 14:37387 (RA;US)
Optimization of separation efficiency in capillary zone electrophoresis, 14:36731 (BA;US)
Respiratory enzymes of Thiobacillus ferrooxidans: Progress report, March 1988–July 1989, 14:37325 (R;US)
Speculation on the mechanism(s) of electrospray ionization, 14:37143 (R;US)

PROTON BEAMS
Unbunched beam electron-proton instability in the PSR and advanced hadron facilities, 14:37063 (R;US)

PROTON REACTIONS
$^{7}Li(p,n)^{7}Be$ and $^{12}C(p,n)^{12}N$ reactions at 200, 300, and 400 MeV, 14:37579 (J;US)
Isovector and isoscalar spin-flip excitations in even-even s-d shell nuclei excited by inelastic proton scattering, 14:37630 (R;FR)

PROTON TRANSPORT
Particle transport simulation for spaceborne, NaI gamma-ray spectrometers, 14:37129 (R;GB)

PROTON-ANTIPROTON INTERACTIONS
Two-scale technicolor, 14:37539 (J;NL)

PROTON-PROTON INTERACTIONS
Multiplicity fluctuations in finite rapidity windows. Intermittency or quantum statistical correlation?, 14:37540 (J;NL)

PROTONS
Automodel properties of baryon clusters in interactions of p-, d-, He-, C- and π^--particles with carbon nuclei within 4-40 GeV/c per nucleon momentum interval, 14:37632 (R;SU;In Russian)
Multiple ionization of xenon by proton impact, 14:37462 (R;US)
Proton backscattering in bulk silicon at large angles of incidence. Final report, 14:36657 (R;US)

PSI RESONANCES
See MESONS

PSI-3105 RESONANCES
See J PSI-3097 MESONS

PSI-4300 RESONANCES
See MESONS
PUBLIC UTILITIES
See also ELECTRIC UTILITIES
GAS UTILITIES
WATER UTILITIES
Least-cost planning in the utility sector: Progress and challenges, 14:36338 (R;US)
PUGET SOUND NAVAL SHIPYARD
Radiological surveys of Naval Facilities on Puget Sound, 14:37278 (R;US)
PULMONARY CANCER
See CARCINOMAS
PULSE COLUMNS
See EXTRACTION COLUMNS
PULSE COMBUSTORS
Development of a pulsed coal combustor fired with CWM [coal-water mixture]: Phase 3, Final report, 14:35582 (R;US)
PULSE GENERATORS
See also HIGH-VOLTAGE PULSE GENERATORS
A battery-powered flux compression generator system, 14:37008 (R;US)
A simultaneous helical generator, 14:37011 (R;US)
Design of an explosive pulsed power system for driving 16-MA plasma flow switch experiments, 14:37734 (R;US)
Disk generator with nearly shockless accelerated driver plate, 14:37010 (R;US)
High-performance, high-current fuses for flux compression generator driven inductive store power conditioning applications, 14:37013 (R;US)
Instability of concave conductor surfaces at high magnetic pressure, 14:37481 (R;US)
The Mark 101 flux compression generator: Development progress, 14:37090 (R;US)
The Mark IX generator, 14:37004 (R;US)
PULSE SHAPERS
Stabilization of charging voltage in high-voltage linear modulator with optron control circuit, 14:37084 (RA;SU;In Russian)
PULSE STRETCHERS
See PULSE SHAPERS
PULVERIZED FUEL ASH
See FLY ASH
PULVERIZED FUELS
Process and system for combustion, especially of slow-reacting coal dust, 14:35589 (R;DE;In German)
PUMPS
See also ROD PUMPS
Vibration monitoring of main coolant pumps: Guideline and reference data: Final report, 14:36096 (R;US)
PURIFICATION
See also HOT GAS CLEANUP
Air purification techniques for radon daughters in uranium mines, 14:35835 (RA;CA;In French)
PWR TYPE REACTORS
See also BELLEFONTE-1 REACTOR
BELLEFONTE-2 REACTOR
CATAWBA-1 REACTOR
CATAWBA-2 REACTOR
DIABLO CANYON-1 REACTOR
DIABLO CANYON-2 REACTOR
LUCIE-1 REACTOR
LUCIE-2 REACTOR
MC GUIRE-1 REACTOR
MC GUIRE-2 REACTOR
OCONEE-1 REACTOR
OCONEE-2 REACTOR
OCONEE-3 REACTOR
POINT BEACH-1 REACTOR
POINT BEACH-2 REACTOR
SEABROOK-1 REACTOR
SEABROOK-2 REACTOR
SEQUOYAH-1 REACTOR
SEQUOYAH-2 REACTOR
SHIPPINGPORT REACTOR
SOUTH TEXAS PROJECT-1 REACTOR
SOUTH TEXAS PROJECT-2 REACTOR
SURRY-1 REACTOR
SURRY-2 REACTOR
THREE MILE ISLAND-1 REACTOR
THREE MILE ISLAND-2 REACTOR
WWER TYPE REACTORS
WATERFORD-3 REACTOR
WATTS BAR-1 REACTOR
WATTS BAR-2 REACTOR
A review of recent developments in pipe damping allowable values for United States nuclear plants, 14:35990 (R;US)
Analysis of the CSNI/GREST core concrete interaction chemical thermodynamic benchmark exercise using the MPEC2 computer code, 14:35993 (R;JP)
Base irradiation history and interim inspection of the KWU/CE test fuel rods of rod groups PK 1 and PK 2: The Studsvik Super-Ramp Project, 14:36013 (R;SE)
Break location effects on PWR small break LOCA phenomena. Inadequate core cooling in lower plenum break test at LSTF, 14:36156 (R;JP)
Closeout of IE Bulletin 80-09: Hydramotor actuator deficiencies, 14:36164 (R;US)
DOE advanced reactor severe accident program (ARSAP) - an overview, 14:36180 (BA;DE)
Development of HPLC techniques for the analysis of trace-metal species in the primary coolant of a pressurized-water reactor, 14:36015 (D;GB)
Mission survey for the Pressure Vessel Research User's Facility (PVRUF), 14:36011 (R;US)
Occupational dose reduction at nuclear power plants: Annotated bibliography of selected readings in radiation protection and ALARA: Volume 4, 14:36159 (R;US)
Some aspects of the research and development programmes on the behaviour of containments during severe accidents, 14:36131 (R;FR)
Test fuel rod fabrication and pre-irradiation characterization report, rod groups PK1, PK2 and BK7: Studsvik Super-Ramp Project, 14:35996 (R;SE)
The Studsvik Super-Ramp Project: Quarterly progress report, April–June, 1982, 14:35999 (R;SE)
The Studsvik Super-Ramp Project: Quarterly progress report, July–September, 1982, 14:36000 (R;SE)
Use of source term code package in the ELEBRA MX-850 system, 14:36132 (R;BR;In Portuguese)
Vibration monitoring of main coolant pumps: Guideline and reference data: Final report, 14:36096 (R;US)
PYRAZOLES
Synergic extraction of metals with 4-acylpyrazol-5-ones and grown ethers, 14:36833 (RA;SU)
PYRIDINE
Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, January 15, 1989–April 15, 1989, 14:35553 (R;US)
[Comparison of the activity of subsurface and surface microorganisms and their anaerobic transformation of heterocyclic compounds]: Progress report, July 1, 1987–June 30, 1989, 14:37326 (R;US)
PYRITE
Electrochemistry of thiobacillus ferrooxidans reactions with pyrite: Technical progress report, January 15–April 15, 1989, 14:35528 (R;US)
Pyrite thermochemistry, ash agglomeration, and char fragmentation during pulverized coal combustion: Quarterly report, December 15, 1988–March 15, 1989, 14:35583 (R;US)
PYRITES
See PYRITE
PYROCATECHIN
See PYROCATECHOL
PYROCATECHOL
Exploratory coprocessing research: Quarterly report number 2, for the period December 1, 1988 to February 28, 1989, 14:35527 (R;US)

PYROLYSIS
See also CALCINATION
Lawrence Livermore National Laboratory oil shale quarterly report, January–March 1989, 14:35731 (R;US)
Liquid fuels from the pyrolysis of municipal solid waste and its components, 14:36442 (BA;US)
PYRROLES
See also INDOLES
Cognition and order in Langmuir-Blodgett films of a 3-hexadecyl pyrrole and ferrocene-derivatized pyrrole mixed monolayer system, 14:36659 (R;US)

Q

QUADRUPOLES
A superconducting iron-dominated quadrupole for CEBAF, 14:36939 (J;US)
QUALITY ASSURANCE
Application of quality principles to training of QA audit personnel, 14:36059 (RA;US)
Guidelines for quality records in electronic media for nuclear facilities (NCIG-10): Final report, 14:36047 (R;US)
Performance based training for quality surveillance personnel, 14:36058 (RA;US)
Proceedings of the DOE quality conference: Managing for quality in a changing environment, 14:37787 (R;US)
QUANTUM CHROMODYNAMICS
Charge screening in gauge theories at finite temperature and density, 14:37551 (R;JP)
Complete computation of high-p_T W and Z production in second-order QCD, 14:37536 (J;NL)
Tests of QCD in photoproduction, 14:37543 (R;FR)
QUANTUM ELECTRODYNAMICS
Charge screening in gauge theories at finite temperature and density, 14:37551 (R;JP)
QUANTUM FIELD THEORY
See also LATTICE FIELD THEORY
QUANTUM CHROMODYNAMICS
QUANTUM ELECTRODYNAMICS
QUANTUM GRAVITY
Classification of integrable two-dimensional models of relativistic field theory by means of computer, 14:37552 (R;SU;In Russian)
Perturbation of c=1 conformal field theory and quantum sine-Gordon theory, 14:37557 (R;JP)
QUANTUM GRAVITY
Quantum mechanical stabilization of Minkowski signature wormholes, 14:37708 (R;US)
QUARKS
Heavy quark physics, 14:37532 (R;US)
Quark mass ratios in semi-leptonic quark decays, 14:37534 (R;US)
Super-hypernuclei in the quark-shell model, 14:37524 (R;JP)
QUATERNARY ALLOY SYSTEMS
Application of quaternary phase diagrams to compound semiconductor processing: Progress report, April 1–December 31, 1988, 14:36480 (R;US)
QUATERNARY COMPOUNDS
Ir, NMR and conductivity study of extracts and the character of the mutual influence of metals in their extraction with alkylammonium salts, 14:36716 (RA;SU)
QUEBEC
Hydro-Quebec development plan, 1988-1990. 1997 outlook. Abridged version, 14:36224 (R;CA;In French)
Hydro-Quebec development plan, 1988-1990. 1997 outlook. Full-length version, 14:36225 (R;CA;In French)
Quebec surface water data, 1987, 14:35873 (R;CA)

R

R CODES
Proposals for improving interphase drag modelling for the bubbly and slug regimes in RELAP5, 14:36001 (R;GB)
RELTREE - A PC program for fault tree construction, documentation and analysis, 14:35982 (RA;XA)
R-1650 RESONANCES
See MESONS
R-RNA
See RIBOSOMAL RNA
RADAPPERTIZATION
See RADIOSTERILIZATION
RADAR
A fully automated, single-connection tester for T/R modules, 14:37146 (R;US)
Real-time optical processor for synthetic aperture radar image formation, 14:37020 (BA;US)
The effects of snow on landmarks in K_u band SAR images, 14:37144 (R;US)
RADIATION ACCIDENTS
Chemical and nuclear emergencies: Interchanging lessons learned from planning and accident experience, 14:37344 (R;US)
Proceedings of the 20th DOE/NRC nuclear air cleaning conference: Sessions 6–15, 14:37201 (R;US)
RADIATION BURDEN
See RADIATION DOSES
RADIATION DAMAGE (BIOLOGICAL)
See RADIATION INJURIES
RADIATION DECONTAMINATION
See DECONTAMINATION
RADIATION DETECTION AND RANGE
See RADAR
RADIATION DETECTORS
See also CHERENKOV COUNTERS
DIELECTRIC TRACK DETECTORS
IONIZATION CHAMBERS
NEUTRON DETECTORS
SHOWER COUNTERS
Superconducting detector for minimum ionizing particles, 14:37123 (J;NL)
RADIATION DOSE DISTRIBUTIONS
Radial distributions of energy deposited along charged particle tracks, 14:37663 (R;US)
RADIATION DOSEMETERS
See DOSEMETERS
RADIATION DOSES
Radiation exposure inside reinforced concrete buildings at Nagasaki, 14:37381 (R;US)
Review of radiation safety at a gamma sterilization plant, 14:37642 (RA;AU)
RADIATION EXPOSURE (DOSES)
See RADIATION DOSES
RADIATION HAZARDS
Evaluation of human internal irradiation owed to Cs-134 and Cs-137 from food after 26.04.1986, 14:37346 (RA;RO;In Romanian)
RADIATION HYGIENE
See RADIATION PROTECTION
RADIATION INJURIES
Experimental model of radiation injuries of liver, 14:37359 (RA;SU;In Russian)
Radiation injuries of the intestine, treated in the Surgical Department of Wuerzburg University Hospital between 1974 and 1982, 14:37355 (R;DE;In German)
RADIATION PROTECTION
An update on standards for radiation in the environment and associated estimates of risk, 14:37345 (R;US)
Main trends of radiation hygiene development in 9 Five-Jear Plan, 14:37646 (RA;SU;In Russian)
Occupational dose reduction at nuclear power plants: Annotated bibliography of selected readings in radiation protection and ALARA: Volume 4, 14:36159 (R;US)
Optimization of radiation protection, 14:35832 (RA;CA)
Radiation hygiene. Collection of scientific papers, 14:37645 (R;SU;In Russian)
Standardization and series production of radiation-shielding items, 14:36874 (RA;SU;In Russian)

RADIATION PROTECTION LAWS
An update on standards for radiation in the environment and associated estimates of risk, 14:37345 (R;US)
RADIATION SAFETY
See RADIATION PROTECTION
RADIATION SYNDROME
Interconnection of individual peculiarities of blood system with radiation syndrome severity in animals, 14:37357 (RA;SU;In Russian)
RADIATION TRANSPORT
Sensitivity/uncertainty analysis for free-in-air tissue kerma due to initial radiation at Hiroshima and Nagasaki, 14:36196 (J;US)
RADICALS
See also CARBENES
Laser spectroscopy and dynamics of combustion intermediates: Three year progress report, 1 June 1986–31 May 1989, 14:36868 (R;US)
RADIOACTIVE AEROSOLS
Experimental verification of the theory of clusters, 14:36744 (RA;CA)
Review of investigations concerning radioactive aerosol deposition in lungs of man, 14:37649 (RA;SU;In Russian)
RADIOACTIVE BIOLOGICAL WASTES
See RADIOACTIVE WASTES
RADIOACTIVE EFFLUENTS
Effluent and environmental monitoring report for calendar year 1988, 14:37204 (R;US)
Removal of radium-226 from uranium mining effluents. Final report of a joint government-industry program, 14:35787 (R;CA)
Westinghouse Hanford Company 100 Areas environmental releases for 1987, 14:35812 (R;US)
RADIOACTIVE GASEOUS WASTES
See RADIOACTIVE WASTES
RADIOACTIVE MATERIALS
See also FISSION PRODUCTS
RADIOACTIVE WASTES
A wind shielded fire test facility, 14:36887 (R;US)
Proceedings of the 20th DOE/NRC nuclear air cleaning conference: Sessions 1–5, 14:37200 (R;US)
Radioactive materials packaging standards and regulations: Making sense of it all, 14:35778 (R;US)
The preparation of TEM specimens from hazardous or difficult materials, 14:36681 (BA;US)
RADIOACTIVE PARTICULATES
See RADIOACTIVE AEROSOLS
RADIOACTIVE WASTE DISPOSAL
A database for reviews and evaluations of high-level waste documents, 14:35820 (BA;US)
Below Regulatory Concern Owners Group: Assessment of the IMPACTS-BRC code: Final report, 14:35786 (R;US)
Below regulatory concern owners group: A general review of the IMPACTS-BRC Code: Final Report, 14:35785 (R;US)
Nuclear waste package container corrosion in simulated salt repository environments, 14:35819 (BA;US)
RADIOACTIVE WASTE FACILITIES
Implementation of an integrated CERCLA-NEPA environmental process at a FUSRAP site, 14:37226 (R;US)
Residual radioactive material guidelines: Methodology and applications, 14:35823 (R;US)
RADIOACTIVE WASTE MANAGEMENT
Conditioning and handling of tritiated wastes at Canadian nuclear power facilities, 14:35770 (R;CA)
Impacts of DOE Order 5820.2A on Oak Ridge National Laboratory, 14:37227 (R;US)
Short summary of International workshop on principles for disposal of radioactive and other hazardous wastes, Stockholm 7-10 june 1988, 14:35791 (R;SE)
[Environmental assessment for radioactive waste disposal, Daeduk, South Korea, May 12–June 14, 1989]: Foreign trip report, 14:35797 (R;US)
RADIOACTIVE WASTE PROCESSING
Development of glass melter for the PNC Tokai Vitrification Facility, 14:35800 (R;JP)
Effective transition from panel board to CRT-based process control, 14:35776 (RA;US)
RADIOACTIVE WASTES
See also ALPHA-BEARING WASTES
HIGH-LEVEL RADIOACTIVE WASTES
LOW-LEVEL RADIOACTIVE WASTES
RADIOACTIVE EFFLUENTS
1987 United Kingdom radioactive waste inventory, 14:35781 (R;GB)
Liquid effluent study project plan, 14:35815 (R;US)
Survey of radioactive waste disposal in Ireland, 14:35788 (R;IE)
VAM2D–Variably saturated analysis model in two dimensions: Version 5.0 with hysteresis and chained decay transport: Documentation and user's guide, 14:35793 (R;US)
RADIOBIOLOGY
Conference handbook, 14:37347 (R;AU)
RADIOCRYSTALLOGRAPHY
See CRYSTALLOGRAPHY
RADIODIAGNOSIS (RADIONUCLIDES)
See NUCLEAR MEDICINE
RADIOFREQUENCY SYSTEMS
See RF SYSTEMS
RADIOGRAPHY (BIOMEDICAL)
See BIOMEDICAL RADIOGRAPHY
RADIOIMMUNOASSAY
Israel EQAS for thyroid related hormones. Final report for the period June 1984 - February 1988, 14:37316 (R;XA)
RADIOISOTOPE MIGRATION
See RADIONUCLIDE MIGRATION
RADIOISOTOPE-LABELLED DRUGS
See RADIOPHARMACEUTICALS
RADIOISOTOPES
See also NEUTRON-DEFICIENT ISOTOPES
Nevada Test Site Radionuclide Inventory and Distribution Program: Report number 5: Areas 5, 11, 12, 15, 17, 18, 19, 25, 26, and 30, 14:35780 (R;US)
US Department of Energy radioisotope customers with summary of radioisotope shipments, FY 1988, 14:35856 (R;US)
[Biospheric model validation in urban, terrestrial, and aquatic environments, Budapest, Hungary, Vienna, Austria, Neuherberg, and Schmallenberg, W. Germany, April 25–May 12, 1988]: Foreign trip report, 14:37661 (R;US)
RADIOLOGICAL PERSONNEL
Annual critique: an effective program evaluation tool, 14:36139 (RA;US)
Guidelines for approved medical officers on health surveillance of radiation workers, 14:37644 (R;IE)
On improved medical surveillance of personnel operating with radiation sources, 14:37652 (RA;SU;In Russian)
Radiation monitoring training system - an aid to performance-based training, 14:36141 (RA;US)
RADIOLOGICAL PROTECTION
See RADIATION PROTECTION
RADIOLOGY
See also BIOMEDICAL RADIOGRAPHY
RADIOTHERAPY
Radiology PRICER 2.0 subroutine installation guide, Volume 1 and Volume 2, 14:37322 (R;US)
Radiology PRICER 2.0 subroutines for RADMAIN and RADPRICE. Software, 14:37321 (R;US)
RADIOLYSIS
Modeling hydrogen water chemistry for BWR applications: Final report, 14:35991 (R;US)
RADIONUCLIDE MIGRATION
Technology assessment guide for application of engineered sorbent barriers to low-level radioactive waste disposal sites, 14:35802 (R;US)
RADIONUCLIDE TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION
RADIONUCLIDES
See RADIOISOTOPES
RADIOPHARMACEUTICALS
Guidelines for the practice of radiopharmacy, 14:36857 (R;AU)

Nuclear Medicine Program progress report for quarter ending December 31, 1988, 14:37320 (R;US)

RADIOPHOTOLUMINESCENT DOSEMETERS
See RPL DOSEMETERS

RADIORESISTANCE
See RADIOSENSITIVITY

RADIOSENSITIVITY
Hygienic significance of radiostability as measures of adaptive feasibilities, 14:37651 (RA;SU;In Russian)

RADIOSTERILIZATION
Conference handbook, 14:37347 (R;AU)
High-dose intercomparison study involving red 4034 perspex and radiochromic dye films, 14:37100 (R;GB)

RADIOSURGERY
See RADIOTHERAPY

RADIOTHERAPY
Radiation injuries of the intestine, treated in the Surgical Department of Wuerzburg University Hospital between 1974 and 1982, 14:37355 (R;DE;In German)

RADIUM 218
Dipole octupole correlations in a boson model and evidence for their existence in nuclei, 14:37631 (R;SU)

RADIUM F
See POLONIUM 210

RADON
Indoor radon, 14:37199 (R;US)
Radon concentrations in air of Polish underground coal mines, 14:35597 (RA;CA)
Radon emanation at the Mullenbach research uranium mine and its effects on ventilation planning, 14:35752 (RA;CA)

RADON 222
1988 DOE model conference proceedings: Volume 3, 14:35773 (R;US)

RAIL TRANSPORT
History of the negotiations of the Washington Metropolitan Area Transit Authority, 14:36408 (R;US)
Transportation rate services, 14:36410 (R;US)

RAILGUN ACCELERATORS
Prototype testing for a hybrid gas-gun/railgun device, 14:36878 (R;US)

RAIN
See also ACID RAIN
Net throughfall chemistry and atmospheric deposition at two forests of different elevations, 14:35924 (J;US)

RANA
See FROGS

RANDOMNESS
Randomization of grab sample strategies for estimating the exposure of uranium miners to radon daughters, 14:35748 (RA;CA)

RAPID TRANSIT SYSTEMS
History of the negotiations of the Washington Metropolitan Area Transit Authority, 14:36408 (R;US)
Super high-speed magnetically levitated system approaches: practical use, 14:36404 (R;JP)
The US market for high-speed maglev vehicles, 14:36401 (R;US)

RARE EARTH ALLOYS
See also CERIUM ALLOYS
LANTHANUM ALLOYS
Low-temperature isotopic exchange in molecular hydrogen on films of transition and rare earth metals and their alloys with copper, 14:36813 (RA;SU;In Russian)

RARE EARTH COMPLEXES
See also CERIUM COMPLEXES
EUROPIUM COMPLEXES
NEODYMIUM COMPLEXES
PRASEODYMIUM COMPLEXES
TERBIUM COMPLEXES
Complex formation of lanthanide(111) with acetylacetone studied by the akufve-lison technique, 14:36827 (RA;SU)
Complexones in the processes of extraction of rare earth elements, 14:36820 (RA;SU)
Ir, NMR and conductivity study of extracts and the character of the mutual influence of metals in their extraction with alkylammonium salts, 14:36716 (RA;SU)
Metal extraction by amides of carboxylic acids, 14:36719 (RA;SU)
Multifunctional organophosphorus extractants: a status report on development and applications, 14:35764 (RA;SU)
Petroleum sulfides, sulfoxides, and sulfones used as extragents (Solvent extraction of actinies, rare earths, transition metals.), 14:36839 (RA;SU)
Prediction and control of extraction ability and some physicochemical properties of extractants (Solvent extraction of actinides and rare earths.), 14:36859 (RA;SU)
Regularities of the extraction of rare earth elements with triisoamyl phosphate, 14:36842 (RA;SU)
Role of the liquid-liquid partition coefficient of the extractable chelate in the extraction efficiency of metals with β-diketones (Metals: rare earths, scandium, yttrium.), 14:36819 (RA;SU)
Size-selective extraction of metal salts: the general principles (Metals: alkali, alkaline earth, rare earth, transition elements, actinides.), 14:36831 (RA;SU)
Some regularities of extraction of rare earth elements by organophosphoric acid, 14:36843 (RA;SU)
Trials on the molecule design of organic extractants, 14:36841 (RA;SU)

RARE EARTH COMPOUNDS
See also DYSPROSIUM COMPOUNDS
EUROPIUM COMPOUNDS
NEODYMIUM COMPOUNDS
SAMARIUM COMPOUNDS
TERBIUM COMPOUNDS
A new potentiometric method for the estimation of the rare earth elements, 14:36851 (BA;US)
Condensed phosphates of rare earth and rare alkali elements, 14:36751 (RA;SU;In Russian)
Double chromates of rubidium, cesium and rare earth elements, 14:36759 (RA;SU;In Russian)
Electric conductivity of ternary phosphates and vanadates of alkali and rare earth metals (Alkali metals: K, Rb, Cs; rare earths: Pr, Ho, Gd.), 14:36746 (RA;SU;In Russian)
Formation conditions and some properties of double nitrates of rare alkali metals and rare earths, 14:36781 (RA;SU;In Russian)
Interaction of lithium chlorides, nitrates, sulfates with rare earths and hexamethylenetramine in aqueous solutions at 25-100 deg C (Rare earths: La, Nd, Yb.), 14:36779 (RA;SU;In Russian)
Phase equilibria in the systems Li_2MoO_4-$BaMoO_4$-$Ln_2(MoO_4)_3$, Ln=La-Lu, Y. Luminescence of $Li_3Ba_2Ln_3(MoO_4)_8$-Nd^{3+}, 14:36760 (RA;SU;In Russian)
Synthesis and physicochemical study of double chlorides, nitrates, sulfates of rubidium and cesium with calcium, lanthanum, neodymium, ytterbium, 14:36782 (RA;SU;In Russian)
Synthesis and structure of mixed by cation ternary vanadates $Me_2MeLn(VO_4)_2$, 14:36745 (RA;SU;In Russian)
Ternary phosphates $Ca_9LiR_23/(PO_4)_7$ (R=rare earths, Y, Bi), 14:36756 (RA;SU;In Russian)

RARE EARTHS
See also GADOLINIUM
LANTHANUM
NEODYMIUM
7. All-union conference on chemistry and technology of rare alkali elements. Summaries of reports, 14:37679 (R;SU;In Russian)
Low-temperature isotopic exchange in molecular hydrogen on films of transition and rare earth metals and their alloys with copper, 14:36813 (RA;SU;In Russian)

RARE GASES
See also ARGON
HELIUM
RADON
XENON
Binding energy of large icosahedral and cuboctahedral Lennard-Jones clusters, 14:37697 (J;DE)
Spectroscopy of absorbers in rare gas-halide laser plasmas, 14:36968 (BA;US)

RBMK TYPE REACTORS
See LWGR TYPE REACTORS

RDF
See REFUSE DERIVED FUELS

REACTION INTERMEDIATES
Laser spectroscopy and dynamics of combustion intermediates: Three year progress report, 1 June 1986–31 May 1989, 14:36868 (R;US)

REACTIVITY
TRUEX process laboratory studies with Hanford complexant concentrate waste: Part 2, Test for solvent poisoning, 14:35806 (R;US)

REACTOR ACCIDENTS
See also LOSS OF COOLANT
MELTDOWN
Accident sequence precursor program: Methods improvements and current results, 14:36173 (BA;DE)
Aerosol sampling and Transport Efficiency Calculation (ASTEC) and application to surtsey/DCH aerosol sampling system: Code version 1.0: Code description and user's manual, 14:36163 (R;US)
Chemical and nuclear emergencies: Interchanging lessons learned from planning and accident experience, 14:37344 (R;US)
Correlation of recent fission product release data, 14:36110 (R;US)
Health effects models for nuclear power plant accident consequence analysis: Low LET radiation: Part 2, Scientific bases for health effects models, 14:37380 (R;US)
Nuclear Accidents Intervention Levels for Protection of the Public, 14:36155 (R;XN)
Nuclear plant analyser, a tool for evaluating actions of accident management, 14:36153 (R;DE;In German)
Nuclear regulation, 14:36146 (R;US)
Reactor safety research results and perspectives, 14:36149 (R;DE;In German)
Some aspects of the research and development programmes on the behaviour of containments during severe accidents, 14:36131 (R;FR)

REACTOR CELLS
ARADAR program abstract, 14:36078 (RA;SU;In Russian)
Abstract of the RADIKF and RADIKF-ES programs, 14:36079 (RA;SU;In Russian)
DEMETRA-ES program, 14:36080 (RA;SU;In Russian)
Difference schemes for solving the equation of the discrete ordinate method in the (Δ,Z) geometry, 14:36075 (RA;SU;In Russian)
On geometric simulating in nuclear reactor calculations by the Monte-Carlo method, 14:36077 (RA;SU;In Russian)
Use of the Monte Carlo method for verification of the accuracy of modern methods for heterogeneous reactor calculations, 14:36076 (RA;SU;In Russian)

REACTOR COMPONENTS
See also BREEDING BLANKETS
FUEL ELEMENTS
REACTOR COOLING SYSTEMS
REACTOR CORES
Effect of peak thermal strain on simplified ratchetting analysis procedures, 14:36084 (R;US)
Precracking and computerized single-specimen J_{Ic} determination for irradiated three-point bend specimens, 14:36172 (BA;US)
Results of the initial phase of the INEL/USNRC large bore hydraulic snubber reliability evaluation program, 14:36144 (R;US)

REACTOR CONTROL SYSTEMS
Dynamics of a reactor with discrete control system under restriction on the control action value, 14:36099 (RA;SU;In Russian)
Reactor power stabilization using a discrete control system, 14:36100 (RA;SU;In Russian)
Supervisory control in a distributed, hierarchical architecture for a multimodular LMR, 14:36094 (R;US)
Support system for loop device operator. Analysis of technological processes, 14:36097 (R;SU;In Russian)

REACTOR CONTROL THEORY
See REACTOR KINETICS

REACTOR COOLING SYSTEMS
See also PRIMARY COOLANT CIRCUITS
RHR SYSTEMS
Aging degradation of BWR feedwater and main steam lines, 14:35989 (R;US)
Equation derivation and studying the dynamics of NPP cooling systems, 14:36087 (RA;SU;In Russian)
Methods and programs for calculating dynamics of thermal-hydraulics processes in nuclear reactors, 14:36071 (RA;SU;In Russian)
Nuclear plant service water system aging degradation assessment: Phase 1, 14:36166 (R;US)
Stress corrosion cracking susceptibility of types 316NG and 316 stainless steel in BWR-type environments, 14:36593 (BA;US)

REACTOR CORES
Calculation analysis of TRIGA MARK II reactor core composed of two types of fuel elements. Final report for the period 1 August 1984 - 31 July 1986, 14:36115 (R;XA)
Graphite structural design code for the High Temperature Engineering Test Reactor, 14:36023 (R;JP;In Japanese)
TMI-2 core debris analytical methods and results, 14:36191 (BA;US)
Technique for multigroup calculation of a two-dimensional reactor in neutron energy slowing-down and thermalization ranges with burnup accounting, 14:36074 (RA;SU;In Russian)

REACTOR FUEL ELEMENTS
See FUEL ELEMENTS

REACTOR FUELS
See NUCLEAR FUELS

REACTOR INSTRUMENTATION
Surveillance of instrumentation channels at nuclear power plants: Volume 2, An approach to classifying problems and solutions: Final report, 14:36095 (R;US)

REACTOR KINETICS
Technique for multigroup calculation of a two-dimensional reactor in neutron energy slowing-down and thermalization ranges with burnup accounting, 14:36074 (RA;SU;In Russian)

REACTOR MATERIALS
See also NUCLEAR FUELS
Closeout of IE Bulletin 83-06: Nonconforming materials supplied by Tube-Line Corporation Facilities at Long Island City, New York; Houston, Texas; and Carol Stream, Illinois, 14:35841 (R;US)

REACTOR MONITORING SYSTEMS
Automation of confidence control for the initial measured data at in-situ level of on-line control system at NPPs with RBMK reactors, 14:36105 (RA;SU;In Russian)
On an approach to NPP diagnostics automation, 14:36103 (RA;SU;In Russian)

REACTOR OPERATION
Development and application of AI technology to plant operation and support, 14:36109 (J;NL)

REACTOR OPERATORS
Performance
Research in operations: lessons learned, 14:36134 (RA;US)
Training
Developing a performance based retraining program for the advanced test reactor (ATR) reactor operators and supervisors, 14:36113 (RA;US)
Developing a systematic approach to team training for emergency response personnel, 14:36135 (RA;US)
Development and implementation of quality based team and diagnostic skills training at the advanced test reactor, 14:36112 (RA;US)
Effective simulator training for BWR operating crews in Japan, 14:35986 (RA;US)
Evaluating learning strategies in operator training programs, 14:36082 (RA;US)
Expectations for training, 14:36002 (RA;US)
Feasibility of quantitative performance measures for evaluating nuclear power plant operators, 14:36046 (RA;US)
Frustration, the challenge and the victory of team building, 14:36045 (RA;US)
Industry activities on operator requalification, 14:36043 (RA;US)
Lessons learned from three years of operator team skills training, 14:36044 (RA;US)

Managing instructor training to achieve excellence, 14:36061 (RA;US)
Managing the training function, 14:36003 (RA;US)
New performance-based examination program for licensed reactor operators, 14:36042 (RA;US)
Research in operations: operator reliability experiments, 14:36133 (RA;US)
SRO supervisory skills, 14:36005 (RA;US)
Simulation facility evaluation program, 14:36039 (RA;US)
Simulator instructor training - a case of utility teamwork, 14:36041 (RA;US)
Team skills training: the critical next step at GPU Nuclear, 14:35985 (RA;US)
Three alternative simulation systems for training nuclear power plant personnel, 14:36040 (RA;US)
Training management - lessons learned, 14:36056 (RA;US)
Training management systems - a comparison, 14:36055 (RA;US)
Training: expectations of an operations superintendent, 14:36054 (RA;US)
Use of statistics to monitor quality in training, 14:35987 (RA;US)

REACTOR PHYSICS
Nuclear reactor physics and technology. Scientific-technical collection, 14:36072 (R;SU;In Russian)
Physics and technology of atomic reactors. Scientific-technical collection, 14:36065 (R;SU;In Russian)

REACTOR PROTECTION SYSTEMS
Closeout of IE Bulletin 80-09: Hydramotor actuator deficiencies, 14:36164 (R;US)

REACTOR SAFETY
International co-operation in the field of operational safety, 14:36130 (R;FR)
Micro-computer fault tree program as a tool for defining problems, 14:35976 (RA;XA)
Microcomputer-based systems and plant analyses - the IRRAS and SARA systems, 14:36174 (BA;DE)
Nuclear plant analyser, a tool for evaluating actions of accident management, 14:36153 (R;DE;In German)
Perspectives of expert systems for nuclear reactor safety, 14:36150 (R;DE;In German)
Reactor safety research results and perspectives, 14:36149 (R;DE;In German)

REACTOR SAFETY EXPERIMENTS
Large-scale experiments and their significance for development and verification of thermal hydraulics computer codes, 14:36151 (R;DE;In German)

REACTOR SHUTDOWN
Improved reliability of residual heat removal capability in pressurized water reactors, 14:36176 (BA;DE)

REACTOR SIMULATORS
Effective simulator training for BWR operating crews in Japan, 14:35986 (RA;US)
Research in operations: operator reliability experiments, 14:36133 (RA;US)
Simulation facility evaluation program, 14:36039 (RA;US)
Simulator application in a nuclear technology degree program, 14:36067 (RA;US)
Simulator instructor training - a case of utility teamwork, 14:36041 (RA;US)
Three alternative simulation systems for training nuclear power plant personnel, 14:36040 (RA;US)

REACTOR TECHNOLOGY
Physics and technology of atomic reactors. Scientific-technical collection, 14:36065 (R;SU;In Russian)

REACTOR VESSELS
An experimental study of the effect of stainless steel cladding on the structural integrity of flawed steel plates in bending, 14:36082 (R;US)
Application of probabilistic fracture mechanics to the pressurized-thermal-shock issue, 14:36168 (BA;US)
Impact of an apparent radiation embrittlement rate on the life expectancy of PWR [pressurized-water-reactor] vessel supports, 14:36006 (R;US)
Life extension approach to the reactor vessel of a nuclear production reactor: Revision 1, 14:36126 (R;US)

REAL TIME SYSTEMS
An architecture for real-time control and data acquisition at LLNL's high explosives application facility (HEAF), 14:37153 (R;US)

RECIPROCAL TRANSLOCATIONS
See CHROMOSOMAL ABERRATIONS

RECOMBINANT DNA
Ionising radiation and its application to biotechnology, 14:37349 (RA;AU)
Recombinant DNA in Japan: current status and future prospects, 14:37302 (R;US)

RECOMBINATION (GENETIC)
See GENE RECOMBINATION

RECORDING SYSTEMS
A solid state video recorder as a direct replacement of a mechanically driven disc recording device in a security system, 14:37812 (R;US)

RECREATIONAL AREAS
Potential supply of minerals from the White Mountains National Recreation Area and Part of the North Steese National Conservation Area Alaska. Appendix A- potential mineral supply analysis methodology, 14:36237 (R;US)

RECYCLE (FUEL)
See FUEL CYCLE

REENTRY VEHICLES
Energy accommodation modeling of rarefied flow over re-entry vehicle geometries using DSMC [Direct Simulation Monte Carlo], 14:36409 (R;US)

REFRIGERANTS
[Discussion of domestic refrigerator/freezer (R/F) design for nonazeotropic refrigerant mixtures (NARMs), Hannover, W. Germany, and visit to Kassel, W. Germany, May 2–5, 1989]: Foreign trip report, 14:36387 (R;US)

REFUELING WATER SYSTEMS
See AUXILIARY WATER SYSTEMS

REFUSE
See SOLID WASTES

REFUSE DERIVED FUELS
Cost goals for biofuels technologies, 14:35864 (BA;US)

REGION V
See FEDERAL REGION V

REGULATIONS
See also POLLUTION REGULATIONS
Implementation of an integrated CERCLA-NEPA environmental process at a FUSRAP site, 14:37226 (R;US)
Lawrence Livermore National Laboratories Environmental Protection Department 1988 California legislative highlights, 14:36233 (R;US)
Radioactive materials packaging standards and regulations: Making sense of it all, 14:35778 (R;US)
Regulatory requirements important to Hanford single-shell tank waste management decisions, 14:35801 (R;US)

REINFORCED CONCRETE
A method for three-dimensional structural analysis of reinforced concrete containment, 14:36142 (R;US)

REINFORCED MATERIALS
See also REINFORCED CONCRETE
Metallurgical aspects of crack-tip failure processes, 14:36590 (BA;US)

RELATIVITY THEORY
Introduction to gravity and cosmology, 14:37439 (R;FR)

RELEASE (FISSION PRODUCT)
See FISSION PRODUCT RELEASE

REM
See DOSE EQUIVALENTS

REMOTE AREAS
Community energy planner, 14:36255 (R;CA)
Village energy retrofit of electric domestic water heating in a B.C. Hydro diesel generating area, 14:36371 (R;CA)

REMOTE HANDLING EQUIPMENT
Chamber for storage and recharging, 14:36876 (RA;SU;In Russian)

REMOTE SENSING
Investigation about the usefulness of Landsat 5 thematic mapper data for mapping forest disease, 14:37160 (R;DE;In German)
RENEWABLE ENERGY SOURCES
See also BIOMASS
GEOTHERMAL ENERGY
HYDROELECTRIC POWER
SOLAR ENERGY
WIND POWER
Conservation and Renewable Energy Program bibliography, 1989 Edition, 14:36370 (R;US)
Decentral dual-purpose power plants, 14:36344 (R;DK;In Danish)
REPRODUCTION
Combined effect of incorporated ^{90}Sr, alcohol, and tobacco smokes on reproduction of warm-blooded animals, 14:37372 (RA;SU;In Russian)
RESEARCH PROGRAMS
See also COORDINATED RESEARCH PROGRAMS
CANMET Catalogue of publications, 1984/1985, 14:36240 (R;CA;In English and French)
Negotiating a license to government technology, 14:36241 (R;US)
Summary of activities of the Research Department 1984, 14:37786 (R;AR;In Spanish)
RESERVOIR ROCK
Establishment of an oil and gas database for increased recovery and characterization of oil and gas carbonate reservoir heterogeneiity: Technical progress report, April 19, 1989–June 30, 1989, 14:35600 (R;US)
Influence of natural fractures on hydraulic fracture propagation, 14:35634 (B;US)
RESID
See PETROLEUM RESIDUES
RESIDENCES
See HOUSES
RESIDENTIAL BUILDINGS
See also HOUSES
Financial options for energy efficiency: A program to reduce the energy cost burden on low income residents, 14:36377 (R;US)
Potential of electric heat pumps for heating water in South Africa, 14:36391 (R;ZA)
RESIDENTIAL SECTOR
Incentives for residential direct load control, 14:36307 (RA;US)
RESIDUAL HEAT REMOVAL
See RHR SYSTEMS
RESIDUAL OILS
See PETROLEUM RESIDUES
RESIDUES (RADIOACTIVE)
See RADIOACTIVE WASTES
RESINS
Determination of the nature and content of antioxidant and antioxidant synergist in PE and XLPE used in cables, 14:36728 (R;CA)
RESONANCE
See also GIANT RESONANCE
On the possilility that (7q,q-bar) resonances decay into (6q) dibaryons, 14:37521 (RA;RO;In Romanian)
Origin of the $^{13}C + {}^{17}O$ resonant structure, 14:37576 (R;FR)
RESONANCE CAVITIES
See CAVITY RESONATORS
RESONANCE SCATTERING
Determination of magnetic field direction in tokamaks from laser-induced Lyman-α fluorescence, 14:37717 (R;FR)
RESOURCE MANAGEMENT
Perspectives on land modelling. Workshop proceedings, 14:36235 (R;CA)
RESPIRABLE DUSTS
See DUSTS
RESPIRATORY SYSTEM DISEASES
Health-hazard evaluation determination report No. 74-78-297, Amax Speciality Metals, Parkersburg, West Virginia, 14:37185 (R;US)
RESTRAINTS
Development of alternate visual examination requirements for dynamic restraints (snubbers), 14:36129 (R;US)
Results of the initial phase of the INEL/USNRC large bore hydraulic snubber reliability evaluation program, 14:36144 (R;US)
RF SYSTEMS
Impact of high temperature superconductors on the possibility of radio-frequency confinement, 14:36914 (J;US)
RHENIUM
Infrared study of carbon deposits on catalysts, 14:36736 (R;US)
RHENIUM COMPLEXES
Metal extraction by amides of carboxylic acids, 14:36719 (RA;SU)
[Ligand intermediates in metalcatalyzed reactions]: Progress report, July 1, 1985–June 30, 1989, 14:36737 (R;US)
RHO-1500 RESONANCES
See MESONS
RHO-1700 RESONANCES
See MESONS
RHODIUM 103
Magnetic moments of low-lying states in ^{103}Rh, $^{111,113}Cd$, and $^{123,125}Te$, 14:37590 (J;US)
RHODIUM ALLOYS
Optical properties of metals and alloys: Au, Ag, FeRh, $AuAl_2$, and $PtAl_2$, 14:36604 (D;US)
RHODIUM COMPLEXES
Chemistry of bimetallic linked cyclopentadienyl complexes: Progress report, 1 December 1986–30 November 1989, 14:36738 (R;US)
RHR SYSTEMS
Improved reliability of residual heat removal capability in pressurized water reactors, 14:36176 (BA;DE)
RIBONUCLEIC ACID
See RNA
RIBOSOMAL RNA
Molecular basis of RNA catalysis. Annual report, March 1988-February 1989, 14:37301 (R;US)
RICHLAND FFTF REACTOR
See FFTF REACTOR
RINGOTRON
See ELECTRON-RING ACCELERATORS
RINGS (STORAGE)
See STORAGE RINGS
RISER CRACKING
See COAL LIQUEFACTION
RISK ANALYSIS
See RISK ASSESSMENT
RISK ASSESSMENT
LAVA [Los Alamos Vulnerability and Risk Assessment] and classical risk analysis, 14:35838 (R;US)
NUREG-1150 risk assessment methodology and results, 14:36177 (BA;DE)
Research in operations: lessons learned, 14:36134 (RA;US)
Systematic problem solving process (SPSP) - root cause analysis that works, 14:36137 (RA;US)
RISKS
See HAZARDS
RIVERS
Experience from integated simulations of runoff, water quality and residence time. International symposium on acidification and water pathways, 14:37264 (RA;NO)
Is the deposition of anthropogenic sulphate onto Scandinavia mature for a harrowing reconsideration ?, 14:37258 (RA;NO)
RIVETS
See FASTENERS
RNA
See also MESSENGER-RNA
RIBOSOMAL RNA
Functional potential of the human LINE-1 family of interspersed repeats, 14:37288 (RA;US)
RNA POLYMERASES
Structural studies of Klenow fragment: an enzyme with two active sites, 14:37297 (BA;US)
ROAD TRANSPORT
Transportation rate services, 14:36410 (R;US)
ROADS
Effects of road condition on the operating costs of buses, 14:36406 (R;ZA)

Effects of road-surface properties on the fuel consumption of trucks and buses, 14:36405 (R;ZA)
Structural-engineering studies on the use of filter dusts from waste-incinerator flue gas cleaning as an aggregate bitumen in road construction, 14:36420 (R;DE;In German)

ROADWAYS (MINES)
See MINE ROADWAYS

ROBOTS
Intelligent robotics and remot systems for the nuclear industry, 14:37816 (J;NL)

ROCK BEDS
A HVAC system based on seasonal heat storage, 14:36212 (RA;CA;In English and French)
Development of heat storage systems with vertical pipes in earth and rock, 14:36207 (RA;CA;In English and French)
Heat pump with a hard rock well equipped for thermal recharging, 14:35931 (RA;CA;In English and French)
The borehole heat store at Lulea, Sweden, 14:36213 (RA;CA;In English and French)

ROCK CAVERNS
The Lyckebo rock cavern seasonal storage plant experience of one year of operation, 14:35935 (RA;CA;In English and French)

ROCK MECHANICS
Analysis of alternative waste isolation concepts, 14:35795 (R;US)
Data compilation report: strata deformation monitoring, No. 3 TBM tunnel, Donkin-Morien mine, N.S., 14:35567 (R;CA)

ROCKS
Attenution of acidity in groundwater flow systems, 14:37260 (RA;NO)
Index of granitic rock masses in the state of Nevada: A compilation of data on 205 areas of exposed granitic rock masses in Nevada, 14:37407 (R;US)
Petrology and mapping of Fe and Ti occurences in Passira country, PE, Brazil, 14:36709 (R;BR;In Portuguese)
Thermal conductivity of rock and soil, 14:36203 (RA;CA;In English and French)

ROCKY MOUNTAINS
Processes affectin the chemistry of waters passing through a high elevator Sierra Nevada watershed, 14:37240 (RA;NO)

ROD PUMPS
Analysis of thermal well pumping performance at the Norcen-Bodo steam pilot, 14:35624 (RA;CA)
New developments in beam pumping technology PC 3000, 14:35723 (RA;CA)
New solutions to oil problems in pumping heavy oil, 14:35620 (RA;CA)
Optimize profits with Diversified Drilling Services Ltd., 14:35622 (RA;CA)

RODS (FUEL)
See FUEL RODS

ROENTGEN EQUIVALENT MAN
See DOSE EQUIVALENTS

ROOF BOLTS
Roofbolt support in board and pillar workings, 14:35576 (R;ZA)
The application of rock bolt design methods to a proposed 7 West crosscut, Prince Mine, Sydney Coalfield, N.S., 14:35568 (R;CA)

ROOFS
Thermal resistance measurement, 14:36396 (R;CA;In English and French)

ROOM AND PILLAR MINING
Roofbolt support in board and pillar workings, 14:35576 (R;ZA)

ROOTS
Effects of ozone and simulated acid rain on mycorrhizal infection in two families of Pinus taeda L, 14:37336 (J;US)

ROUS SARCOMA VIRUS
See ONCOGENIC VIRUSES

RPL DOSEMETERS
Units for detecting surface contamination by alpha radionuclides, 14:37113 (RA;SU;In Russian)

RUBIDIUM
Thermal properties of solid rubidium and cesium, 14:36557 (RA;SU;In Russian)

RUBIDIUM ALLOYS
Comparative analysis of rubidium, cesium-potassium, sodium state diagrams using photometry, 14:36549 (RA;SU;In Russian)
Evaluation of rubidium, cesium - tin, antimony state diagrams, 14:36550 (RA;SU;In Russian)
On photometric studies of rubidium cesium - transition metal systems, 14:36551 (RA;SU;In Russian)

RUBIDIUM FLUORIDES
Cross-luminescence is a method of rare earth element electron structure investigation and physical base for subnanosecond scintillator operation, 14:37680 (RA;SU;In Russian)

RUBIDIUM PHOSPHATES
Phase diagram of the system $RbPO_3$-V_2O_5, 14:36747 (RA;SU;In Russian)

RUBIDIUM TUNGSTATES
Synthesis and properties of double tungstates of rubidium, cesium, and titanium, 14:36765 (RA;SU;In Russian)

RUMEN
See STOMACH

RUNOFF
Experience from integated simulations of runoff, water quality and residence time. International symposium on acidification and water pathways, 14:37264 (RA;NO)

RURAL AREAS
The value of marginal analysis in electric power system operations, 14:36274 (R;US)
Transferring technology. A social marketing perspective, 14:36230 (RA;CA)

RUTHENIUM COMPLEXES
Chemistry of bimetallic linked cyclopentadienyl complexes: Progress report, 1 December 1986–30 November 1989, 14:36738 (R;US)
Study of intermediates from transition metal excited-state electron-transfer reactions: Progress report, August 1, 1986–December 31, 1988, 14:36741 (R;US)

RUTHENIUM OXIDES
Transition metal oxide electrochemical capacitors, 14:37021 (BA;US)

RYDBERG STATES
Ionization of Rydberg energy levels of ions at low temperature, 14:37470 (RA;SU;In Russian)

S

S CODES
Use of source term code package in the ELEBRA MX-850 system, 14:36132 (R;BR;In Portuguese)

S-1000 RESONANCES
See MESONS

SACCHAROMYCES CEREVISIAE
Effect of temperature on Ty transposition, 14:37295 (RA;US)
Effects of DNA damage on transcription and transposition of Ty retrotransposons of yeast, 14:37386 (RA;US)
Genes that affect Ty-mediated gene expression in yeast, 14:37309 (RA;US)

SAFEGUARDS
See also IAEA SAFEGUARDS
The Outsider interruption algorithm, 14:35849 (R;US)

SAFETY
See also OCCUPATIONAL SAFETY
REACTOR SAFETY
Oak Ridge National Laboratory Health and Safety Long-Range Plan: Fiscal years 1989–1995, 14:36880 (R;US)
PRISIM - A computer program that enhances operational safety, 14:35983 (RA;XA)
Practical use of personal computer based methods for NPP operational safety assessment, 14:35979 (RA;XA)
Requirements and methods for a computer based information system on safety parameters and PSA for operational NPP safety management, 14:35978 (RA;XA)
SALP-PC - A fault tree code on personal computer for plant safety assessment, 14:35980 (RA;XA)

Use of the RELVEC code in nuclear power plant operational safety management, 14:35977 (RA;XA)

SAFETY (NUCLEAR)
See RADIATION PROTECTION

SAFETY (REACTOR)
See REACTOR SAFETY

SAHA EQUATION
Ionization equilibrium in dense plasmas, 14:37748 (D;US)

SAHA-LANGMUIR EQUATION
See SAHA EQUATION

SALES
US Department of Energy radioisotope customers with summary of radioisotope shipments, FY 1988, 14:35856 (R;US)

SALINE ZONE
See OIL SHALES
PICEANCE CREEK BASIN

SALMON
Assessing the cost-effectiveness of alternative mitigation strategies: the simulation model, 14:35885 (RA;US)
Economic analyses of fish mitigation strategies, 14:35884 (RA;US)
Juvenile production, 14:35878 (RA;US)
Mathematical programming models of the ocean salmon fishery, 14:35891 (RA;US)
Modeling downstream migration, 14:35879 (RA;US)
Modeling the estuary and early ocean life stanza, 14:35880 (RA;US)
Modeling the late ocean life stanza, 14:35881 (RA;US)
Modeling the upstream migration of adult salmonids, 14:35882 (RA;US)
Procedures for valuing changes in ocean salmon stocks, 14:35892 (RA;US)
Smolt monitoring in the Columbia River Basin, 14:35883 (RA;US)

SALTS
Pressure-dependent melting curve of natural carnallite, $KMgCl_3.6H_2O$, in a closed system, where evaporation is prevented, 14:37416 (R;DK)

SAMARIUM 153
Samarium 153 chelate localization in malignant melanoma, 14:37348 (RA;AU)

SAMARIUM COMPOUNDS
See also SAMARIUM OXIDES
Fundamental magnetic studies of iron-rare-earth-metalloid alloys: Technical performance report, 14:36483 (R;US)

SAMARIUM OXIDES
Investigation of the lanthanide sesquioxides as high temperature transformation toughening agents, 14:36648 (B;US)

SAMPLERS
A large-sample extractor for determining organic contaminants in the Great Lakes, 14:37257 (R;CA)
Review of environmental monitoring equipment for air water and soil systems. Vol. 2-Environmental monitoring equipment database, 14:35966 (R;CA)

SANDSTONES
Fracture-height growth containment using low-permeability bridging agents to stimulate tight gas sands with weak barriers. Topical report, January 1982-March 1985, 14:35680 (R;US)
Site selection for GRI (Gas Research Institute) cooperative tight-gas field research. Volume 1: screening of candidate tight gas formations. Topical report, May-July 1988, 14:35672 (R;US)

SANITARY LANDFILLS
Drum centrifuge modelling of long-term pollutant migration through a soil layer, 14:37222 (R;GB)

SARA CYCLOTRON
AMPHORA detector, 14:37116 (R;FR)

SASKATCHEWAN
The Husky bi-provincial upgrader design basis, 14:35727 (RA;CA)
The newGrade upgrader, 14:35728 (RA;CA)

SASOL PROCESS
Assessment of the techno-economic potential of Fischer-Tropsch slurry reactors, 14:35543 (R;ZA)

SAVANNAH RIVER PLANT
Life extension approach to the reactor vessel of a nuclear production reactor: Revision 1, 14:36126 (R;US)

SCALAR FIELDS
Contribution of the kink-kink interaction to the free energy of a complex scalar nonlinear field, 14:37550 (RA;RO;In Romanian)
On a quantized scalar field in some Kantowski-Sachs' universes, 14:37444 (R;JP)

SCANDINAVIA
See also SWEDEN
Is the deposition of anthropogenic sulphate onto Scandinavia mature for a harrowing reconsideration ?, 14:37258 (RA;NO)

SCANDIUM
Low-temperature isotopic exchange in molecular hydrogen on films of transition and rare earth metals and their alloys with copper, 14:36813 (RA;SU;In Russian)
Nd:Cr:GSGG, will it replace Nd:YAG, 14:36971 (BA;US)

SCANDIUM ALLOYS
Low-temperature isotopic exchange in molecular hydrogen on films of transition and rare earth metals and their alloys with copper, 14:36813 (RA;SU;In Russian)

SCANDIUM COMPLEXES
Electron structure and electrostatic potential of some neutral organophosphorus extractants and their complexes, 14:36818 (RA;SU)
Mechanism of extraction 4th period of periodic system metal ions with carboxylic acids in sulphate systems, 14:36828 (RA;SU)
Role of the liquid-liquid partition coefficient of the extractable chelate in the extraction efficiency of metals with β-diketones (Metals: rare earths, scandium, yttrium.), 14:36819 (RA;SU)
Solvent extraction of scandium pigrate by crown ether and crystal structure of complex between picrate and benzo-15-crown-5, 14:36823 (RA;SU)

SCHOOL BUILDINGS
Evaluation of asbestos levels in two schools before and after asbestos removal. Final report, 14:37181 (R;US)

SCHOOL FACILITIES
See EDUCATIONAL FACILITIES

SCHOOL PLANT
See EDUCATIONAL FACILITIES

SCHOOLS
See EDUCATIONAL FACILITIES

SCOTLAND
See UNITED KINGDOM

SCREW DISLOCATIONS
Pair potential approach for interfaces: fundamental problems and practical solutions, 14:37666 (BA;FR)

SCREWS
See FASTENERS

SCRUBBERS
Submerged gravel scrubber demonstration as a passive air cleaner for containment venting and purging with sodium aerosols—CSTF tests AC7–AC10, 14:36028 (R;US)
Submerged gravel scrubber demonstration tests: Performance of a large-scale unit, 14:36029 (R;US)

SEA DISPOSAL
See MARINE DISPOSAL

SEABROOK-1 REACTOR
Managing the training function, 14:36003 (RA;US)
Technical Specifications, Seabrook Station, Unit 1 (Docket No. 50-443): Appendix "A" to License No. NPF-67, 14:36050 (R;US)

SEABROOK-2 REACTOR
Managing the training function, 14:36003 (RA;US)

SEACOAST
See SHORES

SEALED SOURCES
Theory and practice of sanitary inspection of radiological units, 14:37650 (RA;SU;In Russian)

SEALING MATERIALS
A preliminary pH analysis of coal slurries from the Sydney Coalfield, N.S., 14:35570 (R;CA)

SEALS
Unique applications of tamper indicating devices, 14:35840 (R;US)
SEASONAL THERMAL ENERGY STORAGE
A HVAC system based on seasonal heat storage, 14:36212 (RA;CA;In English and French)
An evaluation of solar heating systems with seasonal storage in New England. Systems using duct storage in rock and heat pump, 14:36198 (RA;CA;In English and French)
Analysis and theoretical design of central solar heating plant with seasonal storage in Poland, 14:35934 (RA;CA;In English and French)
Development of heat storage systems with vertical pipes in earth and rock, 14:36207 (RA;CA;In English and French)
Heat pump with a hard rock well equipped for thermal recharging, 14:35931 (RA;CA;In English and French)
Seasonal storage of heat for district heating in Sweden, 14:36206 (RA;CA;In English and French)
The borehole heat store at Lulea, Sweden, 14:36213 (RA;CA;In English and French)
Thermal energy storage in the energy ecosystem, 14:36215 (RA;CA;In English and French)
SECONDARY BATTERIES
See ELECTRIC BATTERIES
SECONDARY EMISSION
Experiments on secondary ion emission with multicharged keV ion bombardement, 14:37471 (R;FR)
SECONDARY RECOVERY
See ENHANCED RECOVERY
SEDIMENTARY BASINS
Formation and development of deposits in salt strata. Final report, 14:35598 (R;DE;In German)
SEDIMENTS
Ion exchange and soil attenuation of Gulf Coast and Great Plains soils: Final report, 14:37217 (R;US)
Mineralogical behavior of the phosphatic sedimentation in Pernambuco-Paraiba sedimentar coastal basin, 14:37209 (R;BR;In Portuguese)
Radiological survey of San Diego Bay, 14:37279 (R;US)
SEEDLINGS
High temperature flood injury of woody swamp seedlings, 14:35916 (J;US)
SEISMIC EFFECTS
Overview of the development of seismic safety assessment techniques for nuclear power plants, 14:36169 (BA;DE)
Seismic margin screening insights for light water reactors, 14:36170 (BA;DE)
Seismic risk of a BWR, 14:36171 (BA;DE)
SELENIUM
Ion exchange and soil attenuation of Gulf Coast and Great Plains soils: Final report, 14:37217 (R;US)
SELENIUM 77
Gamma-ray-laser pump diagnostic. Final report, 14:37582 (R;US)
SEMICLASSICAL APPROXIMATION
Semiclassical approach to particle resonances and dibaryons, 14:37522 (RA;RO;In Romanian)
SEMICONDUCTOR DEVICES
See also SEMICONDUCTOR DIODES
TRANSISTORS
Nondestructive testing for microelectronics, semiconductors, and superconductors. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:36993 (R;US)
Tool integration and enhancement for standard cell designs, 14:37000 (R;US)
SEMICONDUCTOR DIODES
Photocurrent variability of discrete bipolar devices, 14:37017 (R;US)
SEMICONDUCTOR MATERIALS
Analysis of impurities in semiconductor by IMA (SIMS), 14:36723 (RA;JP;In Japanese)
Charged particle activation analysis of light elements, 14:36721 (RA;JP;In Japanese)
Fermi level stabilization in semiconductors, 14:36698 (BA;US)
Preparation of semiconductor cross sections by cleaving, 14:36686 (BA;US)
Techniques for utilization of nuclear reactor neutrons for semiconductor research. Current situation and problems to be solved in future, 14:36724 (RA;JP;In Japanese)
SENSIBLE HEAT STORAGE
Ground heat technology in Sweden, 14:36200 (RA;CA;In English and French)
SEPARATION EQUIPMENT
See also INERTIAL SEPARATORS
Capillary zone electrophoresis-mass spectrometry of peptides and proteins, 14:37141 (R;US)
SEQUOYAH NUCLEAR POWER PLANT UNIT-1
See SEQUOYAH-1 REACTOR
SEQUOYAH NUCLEAR POWER PLANT UNIT-2
See SEQUOYAH-2 REACTOR
SEQUOYAH-1 REACTOR
Annual radiological environmental operating report, Sequoyah Nuclear Plant, 1988, 14:37230 (R;US)
Plankton studies at Sequoyah Nuclear Plant in 1988, 14:36111 (R;US)
SEQUOYAH-2 REACTOR
Annual radiological environmental operating report, Sequoyah Nuclear Plant, 1988, 14:37230 (R;US)
Plankton studies at Sequoyah Nuclear Plant in 1988, 14:36111 (R;US)
SERVICE WATER SYSTEMS
See AUXILIARY WATER SYSTEMS
SEWAGE
See also SEWAGE SLUDGE
Guide to land treatment of municipal waste water in Illinois, 14:36433 (R;US)
Ocean waste disposal: outfall sewers. January 1977-April 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-April 1989, 14:36441 (R;US)
SEWAGE SLUDGE
Creating fuel oil from sewage sludge, 14:35857 (R;CA;In English and French)
Sewage-sludge pretreatment and disposal. December 1981-February 1988 (Citations from the NTIS data base). Report for December 1981-February 1988, 14:36439 (R;US)
Sewage-sludge pretreatment and disposal. March 1988-April 1989 (Citations from the NTIS data base). Report for March 1988-April 1989, 14:36440 (R;US)
SHALLOW LAND BURIAL
See GROUND DISPOSAL
SHEATHS (FUEL)
See FUEL CANS
SHIELDING MATERIALS
The analysis of lead slump effects in shipping casks for radioactive materials, 14:36894 (R;US)
SHIELDS
See also THERMAL SHIELDS
Study on the optimization with shielding design of marine reactor, 14:36038 (R;JP;In Japanese)
SHIP PROPULSION REACTORS
Study on the optimization with shielding design of marine reactor, 14:36038 (R;JP;In Japanese)
SHIPMENT
See TRANSPORT
SHIPPINGPORT PRESSURIZED WATER REACTOR
See SHIPPINGPORT REACTOR
SHIPPINGPORT REACTOR
A structural evaluation of the Shippingport reactor pressure vessel for transport impact conditions, 14:36014 (R;US)
Shippingport Station Decommissioning Project preparation of the reactor pressure vessel: Topical report, 14:35784 (R;US)
SHORES
Oil at shore and in deposits. Succesive report 1987, 14:35662 (R;NO;In Norwegian)
SHORT CIRCUITS
See ELECTRICAL FAULTS

SHOWER COUNTERS
An Outstanding Junior Investigator Award in experimental high energy physics: Progress report, January 1, 1989 to December 31, 1989, 14:37102 (R;US)
An alignment method for the Mark II silicon strip vertex detector using an x-ray beam, 14:37096 (R;US)
Data acquisition at D0, 14:37105 (R;US)
Progress report of a research program in experimental high energy physics, January 1, 1989–December 31, 1989, 14:37500 (R;US)
Silicon PIN diode hybrid arrays for charged particle detection: Building blocks for vertex detectors at the SSC, 14:37119 (R;US)

SHRUBS
Ecophysiology and adaptation in desert shrubs: Final report, 14:37206 (R;US)

SHUTDOWN (REACTOR)
See REACTOR SHUTDOWN

SI SEMICONDUCTOR DETECTORS
Development of new type of silicon detector with internal amplification, 14:37117 (R;DE;In German)

SIALON
See ALUMINIUM OXIDES
SILICON NITRIDES

SIGMA MODEL
Stable static solitons in the nonlinear sigma model with a topological term, 14:37558 (J;NL)

SIGMA-410 RESONANCES
See SIGMA MODEL

SIGNAL CONDITIONING
Thin-film optics for signal-processing applications. Final report, 1 September 1986-31 May 1988, 14:36999 (R;US)

SILICA
Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1, 14:35538 (R;US)
Study of long range forces in epitaxy systems: the Ag/Si interface, 14:36621 (BA;FR)

SILICEOUS ROCK
See SANDSTONES

SILICON
Activation Analysis
Qualitative and quantitative investigation of trace impurities (about 30 elements) in Si by neutron activation analysis, 14:36722 (RA;JP;In Japanese)
Activation Energy
Migration of differently oriented grain boundaries measured on Fe-3wt%Si 37° (001) bicrystals, 14:36522 (BA;FR)
Computerized Simulation
Fragmentation and structure of silicon microclusters, 14:37691 (BA;US)
Crystal Lattices
Breathing mode lattice relaxation associated with carrier emission and capture by deep electronic levels in silicon, 14:36689 (BA;US)
Lattice relaxation of the DX centers in $Ga_{1-x}Al_xAs$ and of the pressure-induced deep donors in GaAs, 14:36699 (BA;US)
Crystal Structure
Study of long range forces in epitaxy systems: the Ag/Si interface, 14:36621 (BA;FR)
Crystal-Phase Transformations
Hexagonal silicon, 14:36691 (BA;US)
Deep Level Transient Spectroscopy
Pressure-dependent DLTS experiments on Si-doped AlGaAs, 14:36700 (BA;US)
Dislocations
Depth-dependent character of extended defects in ion-implanted and RTA'd Si, 14:36690 (BA;US)
Electric Conductivity
EBIC and DLTS measurements of SI- and polycrystalline silicon, 14:36673 (BA;FR)
Structure and local electrical properties of grain boundaries in polycrystalline semiconductors, 14:36672 (BA;FR)
Grain Boundaries
Grain boundaries in silicon from zero temperature through melting, 14:36476 (R;US)
Grain-boundary dislocations structure and movement in Σ=9 studied by HREM, 14:36496 (BA;FR)
Structure and local electrical properties of grain boundaries in polycrystalline semiconductors, 14:36672 (BA;FR)
Interactions
Interactions of implanted carbon with oxygen and nitrogen in silicon, 14:36692 (BA;US)
Mechanical Properties
Critical phenomenon and segregation behavior at interfaces and subgrain boundaries, 14:36540 (BA;FR)
Oxidation
Effects of carbon concentration upon oxygen precipitation in Cz Si, 14:36694 (BA;US)
Phase Studies
Study of long range forces in epitaxy systems: the Ag/Si interface, 14:36621 (BA;FR)
Phase Transformations
Two dimensional phase equilibria at surfaces, 14:37671 (BA;FR)
Physical Radiation Effects
Proton backscattering in bulk silicon at large angles of incidence. Final report, 14:36657 (R;US)
Radiation damages in silicon induced by highly energetic electrons and protons, 14:36676 (R;DE;In German)
Sample Preparation
In situ high-temperature cross-sectional TEM specimen preparation, 14:36651 (BA;US)

SILICON 28 TARGET
Isovector and isoscalar spin-flip excitations in even-even s-d shell nuclei excited by inelastic proton scattering, 14:37630 (R;FR)

SILICON CARBIDES
Characterization of fiber-reinforced particulate filters, 14:35961 (R;US)
Interfacial characteristics of glass-ceramic matrix/SiC fiber composites, 14:36634 (BA;FR)
Mechanical behaviors of SiC whisker reinforced Al composites by powder metallurgical process, 14:36528 (BA;FR)
Phase transformation in boron doped SiC: HREM study of a twin interface, 14:36630 (BA;FR)
SiC-$MoSi_2$ composites, 14:36638 (R;US)

SILICON COMPOUNDS
See also SILICON CARBIDES
SILICON NITRIDES
SILICON OXIDES
The structure of the boron-hydrogen complex in silicon, 14:36695 (BA;US)

SILICON NITRIDES
Atomic structure of vitreous interfacial films in sialon, 14:36671 (BA;FR)
Diffusion reactions between silicon oxynitride and silicon nitride during HIP-synthesis, 14:36625 (BA;FR)
Interfacial characteristics of glass-ceramic matrix/SiC fiber composites, 14:36634 (BA;FR)
Noncontacting laser diffraction strain extensometer for material properties characterization at high temperatures, 14:36617 (R;US)

SILICON OXIDES
See also SILICA
Atomic structure of vitreous interfacial films in sialon, 14:36671 (BA;FR)
Interfacial characteristics of glass-ceramic matrix/SiC fiber composites, 14:36634 (BA;FR)

SILICON SEMICONDUCTOR DETECTORS
See SI SEMICONDUCTOR DETECTORS

SILICON SOLAR CELLS
Research on stable, high-efficiency, large-area, amorphous-silicon-based submodules, Task B: Semiannual subcontract report, 16 March 1988–15 September 1988, 14:35914 (R;US)

SILOXANES
Development of a membrane SO_x/NO_x treatment system: Final report, 28 April 1987–28 April 1988, 14:35957 (R;US)

SILVER
Common factors controlling grain and phase boundary energy, 14:36517 (BA;FR)
Hetero phase boundaries in the silver-nickel system, 14:36515 (BA;FR)
Ion-assisted deposition of silver films on ceramics for friction and wear control, 14:36478 (R;US)
New ideas on interface structure from significant disagreements between experiments and prediction of interface composition in Ag base alloys, 14:36505 (BA;FR)
Optical properties of metals and alloys: Au, Ag, FeRh, $AuAl_2$, and $PtAl_2$, 14:36604 (D;US)
Structure of Ag, Fe and Ge microclusters, 14:37477 (J;DE)
Study of long range forces in epitaxy systems: the Ag/Si interface, 14:36621 (BA;FR)

SILVER ALLOYS
Interfacial structure modifications induced by sulfur in Ag-Ni alloys, 14:36506 (BA;FR)
Subcritical crack growth in metal-ceramic-interfaces, 14:36986 (BA;FR)

SILVER PHOSPHATES
Properties of mixed polyphosphates of silver and rare alkali metals (Alkali metals: Li, Rb, Cs.), 14:36754 (RA;SU;In Russian)

SIMS
See MASS SPECTROSCOPY

SIMULATORS (REACTOR)
See REACTOR SIMULATORS

SINGLE-PARTICLE MODES
High lying and high spin states in heavy nuclei via transfer reactions, 14:37629 (R;FR)

SLAGS
Leaching characteristics of incinerator residues and potential for modification of leaching, 14:36431 (R;NL)
Strategies for combatting problems caused by cathode slag shorting, 14:36353 (BA;US)

SLC
See STANFORD LINEAR COLLIDER

SLOT OVENS
See COKE OVENS

SLOWING-DOWN THEORY (NEUTRON)
See NEUTRON SLOWING-DOWN THEORY

SLUDGES
See also SEWAGE SLUDGE
Trace metal removal by iron coprecipitation: Field evaluation: Final report, 14:35960 (R;US)

SLUGS (FUEL)
See FUEL RODS

SLURRIES (FUEL)
See FUEL SLURRIES

SMALL-SCALE HYDROELECTRIC POWER PLANTS
Andhi Khola Hydel and Rural Electrification Project (AHREP) Nepal. Low cost hydropower with maximum local training, 14:35871 (RA;CA)
Build-operate-transfer concept. A case history from Turkey, 14:35870 (RA;CA)
Small hydro in Canada, 1988, 14:35874 (RA;CA)

SMES
See SUPERCONDUCTING MAGNETIC ENERGY STORAGE

SMOKATRON
See ELECTRON-RING ACCELERATORS

SMOKES
Statistics on smoke and sulfur dioxide pollution in South Africa. Special report, 14:37187 (R;ZA)

SNOW
Quality of surface water evolution during snowmelt. International symposium on acidification and water pathways, 14:37238 (RA;NO)
The effects of snow on landmarks in K_u band SAR images, 14:37144 (R;US)

SODIUM ALLOYS
Comparative analysis of rubidium, cesium-potassium, sodium state diagrams using photometry, 14:36549 (RA;SU;In Russian)
Relationships of structural to thermodynamic properties of sodium-cesium melts, 14:36556 (RA;SU;In Russian)

SODIUM CHLORIDES
Molecular dynamics study of the structure and properties of twist boundaries, 14:36669 (BA;FR)
Search for experimentally observed grain boundary phase transitions, 14:36498 (BA;FR)

SODIUM IODIDE DETECTORS
See NAI DETECTORS

SODIUM MINERALS
See MINERALS

SODIUM SULFATES
Coal ash deposition, interaction with metal substrates and deposit build up: Summary report, 26 February 1989–25 May 1989, 14:35586 (R;US)

SODIUM-SULFUR BATTERIES
Electrode-induced beta battery degradation. Final report, 14:36222 (R;US)

SOFT X RADIATION
High intensity laser-matter interactions, 14:37745 (B;US)
Investigation of the production of nitric oxide by soft solar x rays in the e-region of the ionosphere. Master's thesis, 14:37449 (R;US)

SOIL MECHANICS
Modelling of fracture and deformation processes in oil sands, 14:37415 (RA;CA)
Shear dilatency and permeability enhancement in oil sands, 14:35735 (RA;CA)

SOILING
See SURFACE CONTAMINATION

SOILS
1988 DOE model conference proceedings: Volume 4, 14:35774 (R;US)
Acidification and water pathways. What about the future?, 14:37273 (RA;NO)
Alkalinity production in soil and rock: A useful concept for understanding acidification of soil and freshwater, 14:37259 (RA;NO)
Capacity of saturated or unsaturated soil to restore calories by gelation, 14:36202 (RA;CA;In English and French)
Conceptual model for analysing soil and groundwater acidification on regional scale. International symposium on acidification and water pathways, 14:37239 (RA;NO)
Containment of organic leachates from leaking underground storage tanks using tailored soils as liners, 14:37216 (R;US)
Mathematical model for podzolic soil profiles exposed to acid deposition, 14:37272 (RA;NO)
Presentation of a software package for automated evaluation of soil heat storage projects, 14:36210 (RA;CA;In French)
Relation between water flow paths in the soil and runoff chemistry at Risdalsheia, a small headwater catchment in southern Norway, 14:37265 (RA;NO)
Release of dispersed asbestos fibres from soils, 14:37190 (R;GB)
Thermal conductivity of rock and soil, 14:36203 (RA;CA;In English and French)
Transient response of an in-ground vertical cylindrical heat exchanger. Thermal characterization of the soil, 14:36199 (RA;CA;In French)
Use of industrial-hygiene samplers for soil-gas measurement, 14:37221 (R;US)
Use of representative field plots for the determination of hydrological flow-paths and associated hydrochemistry in studies of surface water acidification, 14:37261 (RA;NO)

SOLAR ACTIVITY
See also SOLAR FLARES
SOLAR GRANULATION
Study of fine-scale solar dynamics. Final report, 6 September 1985-31 October 1988, 14:37423 (R;US)

SOLAR CELLS
See also CADMIUM TELLURIDE SOLAR CELLS
COPPER SELENIDE SOLAR CELLS
INDIUM SELENIDE SOLAR CELLS
SILICON SOLAR CELLS

Materials analysis and device optimization of $CuInSe_2$ solar cells: Annual subcontract report, 16 January 1987–15 January 1988, 14:35913 (R;US)

SOLAR CONCENTRATORS
Transparent glass ceramics doped by chromium(iii) and chromium(iii) and neodymium(iii) as new materials for lasers and luminescent solar concentrators. Final report, 1 October 1985-30 June 1988, 14:35928 (R;IL)

SOLAR COOLING SYSTEMS
Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of May and June 1989, 14:35927 (R;US)

SOLAR DISTRICT HEATING
A solar heating plant with heat pump and seasonal storage. System design influence on thermal performance and economy, 14:35936 (RA;CA;In English and French)
Analysis and theoretical design of central solar heating plant with seasonal storage in Poland, 14:35934 (RA;CA;In English and French)
Technical and economic feasibility of central solar heating plants with seasonal storage, 14:35932 (RA;CA;In English and French)
The Lyckebo rock cavern seasonal storage plant experience of one year of operation, 14:35935 (RA;CA;In English and French)

SOLAR ENERGY
An evaluation of solar heating systems with seasonal storage in New England. Systems using duct storage in rock and heat pump, 14:36198 (RA;CA;In English and French)
Heat pump with a hard rock well equipped for thermal recharging, 14:35931 (RA;CA;In English and French)

SOLAR FLARES
Study of weak solar magnetic fields. Final report, 1 December 1987-30 November 1988, 14:37424 (R;US)

SOLAR GRANULATION
Precise proper-motion measurement of solar granulation, 14:37421 (R;US)
Temporal variations of solar-spectral-line profiles induced by the 5-minute photospheric oscillation, 14:37422 (R;US)

SOLAR HEATING SYSTEMS
See also PASSIVE SOLAR HEATING SYSTEMS
Analysis and theoretical design of central solar heating plant with seasonal storage in Poland, 14:35934 (RA;CA;In English and French)
Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of May and June 1989, 14:35927 (R;US)
Model of a heating installation consisting of solar collectors, storage tank and heat pump, 14:35937 (RA;CA;In English and French)
Optimization of a combined heat pump/storage system with solar or convective heat collectors, 14:36382 (RA;CA;In English and French)
The Vaulruz project experimental results, 14:35933 (RA;CA;In English and French)

SOLAR NEUTRINOS
Measurement of solar proton-proton fusion neutrinos with a Soviet-American gallium experiment: Technical progress report, 14:37583 (R;US)

SOLAR RADIATION
Investigation of the production of nitric oxide by soft solar x rays in the e-region of the ionosphere. Master's thesis, 14:37449 (R;US)
Temporal variations of solar-spectral-line profiles induced by the 5-minute photospheric oscillation, 14:37422 (R;US)

SOLAR THERMAL CONVERSION
Solar thermal program summary: Volume 2, Research summaries: Fiscal year 1988, 14:35925 (R;US)

SOLDERED JOINTS
A test system for thermomechanical fatigue of solder joints, 14:36585 (R;US)

SOLENOIDS
SSC detector solenoid, 14:36925 (J;US)

SOLID ELECTROLYTES
Electrode-induced beta battery degradation. Final report, 14:36222 (R;US)

SOLID SCINTILLATION DETECTORS
See also NAI DETECTORS
AMPHORA detector, 14:37116 (R;FR)

SOLID STATE LASERS
See also NEODYMIUM LASERS
Fracture mechanisms and strengthening of slab lasers, 14:36683 (BA;US)
Laser action in chromium-activated forsterite for near-infrared excitation, 14:36959 (R;US)
Nonlinear optical beam manipulation, beam combining, and atmospheric propagation, 14:36967 (B;US)

SOLID STATE PHYSICS
Competing interactions and complexity in condensed matter, 14:37687 (R;US)

SOLID WASTES
See also WOOD WASTES
Design guidelines for a furnace sorbent injection waste management system: Final report, 14:35959 (R;US)
Final Environmental Impact Statement. Qaste reduction, recycling, and disposal alternatives. Recycling potential assessment and waste stream forecast. Volume 2, 14:36434 (R;US)

SOLIDS
DYNA3D user's manual: (Nonlinear dynamic analysis of structures in three dimensions): Revision 5, 14:36893 (R;US)
Spatial structure of transient plasmas revealed with a CCD camera, 14:37746 (BA;US)

SOLIDS FLOW
Advanced instrumentation for local measurement of gas-solid suspension flows: Quarterly technical progress report No. 9/10, November 1, 1988–April 30, 1989, 14:35577 (R;US)

SOLVENT EXTRACTION
International solvent extraction conference. Vol. 1. Conference papers, 14:36715 (R;SU;In Russian)
Modeling of flow fields in oscillating droplets, 14:36983 (BA;US)
Recent advances in centrifugal contactor design, 14:35822 (J;US)

SOOT
Enhanced flame stability and soot radiation using electric fields. Annual report, July 1987-July 1988, 14:35687 (R;US)
Suppression of soot in flames by alkaline-earth and other metal additives, 14:36866 (R;US)

SORPTION
Technology assessment guide for application of engineered sorbent barriers to low-level radioactive waste disposal sites, 14:35802 (R;US)

SORTING
A virtual zero-time, monolithic systolic sorting array, 14:37798 (R;US)

SOURCE TERMS
Use of source term code package in the ELEBRA MX-850 system, 14:36132 (R;BR;In Portuguese)

SOUTH AFRICA
Impact upon US security of a South African nuclear-weapons capability. Final technical report, 14:36458 (R;US)
Potential of electric heat pumps for heating water in South Africa, 14:36391 (R;ZA)
Statistics on smoke and sulfur dioxide pollution in South Africa. Special report, 14:37187 (R;ZA)

SOUTH TEXAS PROJECT-1 REACTOR
Systematic problem solving process (SPSP) - root cause analysis that works, 14:36137 (RA;US)

SOUTH TEXAS PROJECT-2 REACTOR
Systematic problem solving process (SPSP) - root cause analysis that works, 14:36137 (RA;US)

SPACE
See also INTERSTELLAR SPACE
Stability of laser beams in a structured environment, 14:36975 (BA;US)

SPACE CHARGE
Magnetic field-aligned plasma expansion in critical ionization velocity space experiments, 14:37459 (J;US)

SPACE FLIGHT
Risk assessment and late effects of radiation in low-earth orbits, 14:37343 (R;US)
SPACE HEATING
Conversion of detached houses with direct electric heating to district heating, 14:36374 (R;SE;In Swedish)
Optimization of a combined heat pump/storage system with solar or convective heat collectors, 14:36382 (RA;CA;In English and French)
SPACE PROPULSION REACTORS
Small propulsion reactor design based on particle bed reactor concept, 14:36128 (R;US)
SPACE REFLECTION
See P INVARIANCE
SPACE-TIME
Compactifications of the eleven-dimensional supermembrane, 14:37700 (R;XA)
SPACECRAFT POWER SUPPLIES
Safety testing program for the Galileo mission radioisotope thermoelectric generator, 14:36158 (R;US)
SPECIAL RELATIVITY THEORY
See RELATIVITY THEORY
SPECIFIC GRAVITY
See DENSITY
SPECIFIC VOLUME
See DENSITY
SPECIFIC WEIGHT
See DENSITY
SPECTRAL SHIFT
Shape transition in neutron deficient PT isotopes, 14:37592 (R;FR)
SPECTROMETERS
See also ELECTRON SPECTROMETERS
FOURIER TRANSFORM SPECTROMETERS
GAMMA SPECTROMETERS
MASS SPECTROMETERS
NEUTRON SPECTROMETERS
A superconducting dipole concept for the CEBAF high resolution spectrometers, 14:36943 (J;US)
A superconducting iron-dominated quadrupole for CEBAF, 14:36939 (J;US)
Plastic Ball experiments, 14:37110 (R;DE)
Technical advisory panel for the large acceptance spectrometer: Final report, 14:37108 (R;US)
Workshop on CEBAF [Continuous Electron Beam Accelerator Facility] spectrometer magnet design and technology: Proceedings, 14:37107 (R;US)
SPENT FUEL CASKS
Cask drop testing and analysis, 14:36869 (R;US)
GACAP: A new computer code for analysis of symmetric and nonsymmetric cask cross sections, 14:36871 (R;US)
Investigation of cask contamination weeping: A progress report, 14:36888 (R;US)
TRUPACT I filter development: Status report, 14:36883 (R;US)
The analysis of lead slump effects in shipping casks for radioactive materials, 14:36894 (R;US)
SPENT FUEL STORAGE
See also MONITORED RETRIEVABLE STORAGE
Design considerations for on-site spent-fuel transfer systems: Final report, 14:35767 (R;US)
SPENT FUELS
An evaluation of near-field host rock temperatures for a spent fuel repository, 14:35805 (R;US)
Simulation of a continuous rotary dissolver, 14:35763 (R;US)
Treatment needs for Greater-Than-Class C low-level waste, 14:35804 (R;US)
SPIN
Low-spin states in ^{122}Cs, 14:37589 (R;FR)
Spin value of ^{184}Ir ground state, 14:37627 (R;FR)
SPIN GLASS STATE
Dynamical properties in metallic reentrant in spin glasses studied by inelastic neutron scattering, 14:36546 (R;FR;In French)
SPIN-OFF
See TECHNOLOGY TRANSFER
SPIN-SPIN RELAXATION
Nuclear relaxation rates at copper and oxygen sites in $YBa_2Cu_3O_7$, 14:36640 (R;US)
SPONTANEOUS MUTATIONS
Mobile DNA elements and spontaneous gene mutation, 14:37305 (RA;US)
Mobile genetic elements, spontaneous mutations, and the assessment of genetic radiation hazards in man, 14:37342 (RA;US)
SPRAY DRYING
10-MW spray dryer/ESP pilot plant test program: High-sulfur coal test phase (phase 3): Final report, 14:35962 (R;US)
SPRAY PONDS
See SPRAYS
SPRAYS
Secondary atomization of coal-water fuels for gas turbine applications: Final report, 14:35581 (R;US)
SQUID DEVICES
Hot electron effect in the dc SQUID, 14:36903 (J;US)
Nuclear magnetic resonance with dc SQUID preamplifiers, 14:36905 (J;US)
STABILITY
A synopsis of analyses (1981–87) performed to assess the stability of underground excavations at Yucca Mountain: Yucca Mountain Project, 14:35808 (R;US)
STAINLESS STEEL-18-4-1
See STAINLESS STEELS
STAINLESS STEEL-19-9DL
See STAINLESS STEELS
STAINLESS STEEL-304
Coal ash deposition, interaction with metal substrates and deposit build up: Summary report, 26 February 1989–25 May 1989, 14:35586 (R;US)
Creep-fatigue assessment methods using elastic analysis results and adjustments, 14:36588 (R;US)
Effect of temperature and ionic impurities at very low concentrations on stress corrosion cracking of sensitized type 304 stainless steel, 14:36594 (BA;US)
Evaluating the intergranular SCC resistance of sensitized Type 304 stainless steel in low-temperature water environments, 14:36601 (BA;US)
Life extension approach to the reactor vessel of a nuclear production reactor: Revision 1, 14:36126 (R;US)
The Sigmajig: An improved hot-cracking test, 14:36479 (R;US)
STAINLESS STEEL-310
Heat exchanger development for steam-injected Brayton cycle: Final report for period September 30, 1984 to April 30, 1988, 14:36577 (R;US)
STAINLESS STEEL-316
Stress corrosion cracking susceptibility of types 316NG and 316 stainless steel in BWR-type environments, 14:36593 (BA;US)
The Sigmajig: An improved hot-cracking test, 14:36479 (R;US)
STAINLESS STEELS
See also CHROMIUM STEELS
An experimental study of the effect of stainless steel cladding on the structural integrity of flawed steel plates in bending, 14:36082 (R;US)
STANDARD MODEL
Ground state of high-density matter, 14:37541 (J;NL)
What is special about the group of the standard model?, 14:37528 (R;DK)
STANDING CROP
See BIOMASS
STANFORD LINEAR COLLIDER
Applications of a plasma lens with bootstrap disruption, 14:37065 (R;US)
PHASEFIX: Correcting the tunes of the SLC Arcs, 14:37066 (R;US)
RF phase distribution systems at the SLC, 14:37094 (R;US)
Recent commissioning experience on the SLC Arcs, 14:37095 (R;US)
Retractable carbon fibre targets for measuring beam profiles at the SLC collision point, 14:37126 (J;NL)

STARCH GUM
See DEXTRIN
STARFISH EVENT
Some aspects of Starfish, 14:37154 (R;US)
Study of coupling in Starfish, 14:37155 (R;US)
STATIONARY POLLUTANT SOURCES
Atmospheric modeling of air pollution. September 1984-March 1988 (Citations from the NTIS data base). Report for September 1984-March 1988, 14:37194 (R;US)
STATISTICAL MECHANICS
4. International symposium on selected topics in statistical mechanics, 14:37702 (R;SU;In Russian)
STATISTICS
ORMONTE: An uncertainty analysis code for use with user-developed systems models on mainframe or personal computers: A user's guide, 14:37808 (R;US)
STEADY-STATE D-T REACTORS
To the problem of thermal stability of a stellarator reactor, 14:37764 (RA;SU;In Russian)
STEAM GENERATORS
A finite-element model for eddy-current nondestructive evaluation: Final report, 14:36086 (R;US)
Evaluation of SCC test methods for Inconel 600 in low-temperature aqueous solutions, 14:36175 (BA;US)
STEAM INJECTION
A theoretical and experimental study of steam-assisted gravity drainage process, 14:35709 (RA;CA)
Analysis and implementation of the steam assisted gravity drainage process at the AOSTRA UTF, 14:35708 (RA;CA)
Aspects of alloy selection in thermal recovery of heavy crudes and tar sands, 14:36467 (RA;CA)
Heavy oil recovery through immiscible displacement by carbon dioxide, 14:35604 (RA;CA)
In situ oil sands temperature logging, 14:35725 (RA;CA)
Laboratory examinations of a new downhole steam generator, 14:35605 (RA;CA)
New technologies in termalrecovery contribution of horizontal wells, 14:35611 (RA;CA)
Oil sands formation preheating study, 14:35714 (RA;CA)
Optimization of heavy oil thermorecovery made possible with a novel in-situ process, 14:35715 (RA;CA)
Reducing wellbore heat loss, 14:35623 (RA;CA)
Simulation of HASDrive UTF pilot, 14:35693 (RA;CA)
Steam-CO_2 injection to recover heavy oil in limestones, 14:35608 (RA;CA)
STEAM SOAK PROCESSES
Design and evaluation of pilot tests of steam soak with additives in Venezuela heavy oil reservoirs, 14:35607 (RA;CA)
STEEL INDUSTRY
See METAL INDUSTRY
STEEL-000KH20N20
See NICKEL-CHROMIUM STEELS
STEEL-000KH25
See STAINLESS STEELS
STEEL-000KH28
See STAINLESS STEELS
STEEL-00KH20N32T
See STAINLESS STEELS
STEEL-03KH13AG13
See STAINLESS STEELS
STEEL-08G2SFB
See CARBON STEELS
STEEL-0KH18G8N2T
See STAINLESS STEELS
STEEL-1-KH18N20T3P
See NICKEL-CHROMIUM STEELS
STEEL-12KH2MV8FB
See STEELS
STEEL-12KH2V5FB
See STEELS
STEEL-1KH12V2MF
See CHROMIUM STEELS
STEEL-37KHN3T
See NICKEL-CHROMIUM STEELS
STEEL-40KH2N5SM
See NICKEL-CHROMIUM STEELS
STEEL-9KHS
See CHROMIUM STEELS
STEEL-ASTM-A285
Monitoring of corrosion in ORGDP cylinder yards, 14:35777 (R;US)
STEEL-ASTM-A516
Monitoring of corrosion in ORGDP cylinder yards, 14:35777 (R;US)
STEEL-ASTM-A533-B
Post-irradiation fracture toughness characterization of four lab-melt plates: Revision 1, 14:36578 (R;US)
Relaxation response of A533B steel from 25 to 600°C, 14:36474 (R;US)
STEEL-KH12N20T3P
See NICKEL-CHROMIUM STEELS
STEEL-KH13S2YU2BT
See CHROMIUM STEELS
STEEL-KH18N22V2T2
See NICKEL-CHROMIUM STEELS
STEEL-KHN35VT
See NICKEL-CHROMIUM STEELS
STEEL-N26KHT1
See NICKEL-CHROMIUM STEELS
STEEL-R18
See CHROMIUM STEELS
STEEL-VZH102
See NICKEL-CHROMIUM STEELS
STEELS
See also AUSTENITIC STEELS
CARBON STEELS
LOW ALLOY STEELS
Corrosion inhibition in sour media, 14:36469 (R;CA)
Crack growth behavior and modeling: Topical report, 14:36466 (R;US)
Development of an engineering definition of the extent of J singularity controlled crack growth, 14:36579 (R;US)
Diffusion at explosion welding of titanium with steel, 14:36568 (RA;SU;In Russian)
Effect of manganese on intergranular fracture in low alloy steels, 14:36537 (BA;FR)
Estimating fracture toughness using tension or ball indentation tests and a modified critical strain model, 14:36475 (R;US)
Generic steel designs for tidal power barrages. V. 1, pt. 1, 14:35950 (R;GB)
Generic steel designs for tidal power barrages. V. 1, pt. 2, 14:35951 (R;GB)
Intergranular fracture in metals, 14:36985 (BA;FR)
Metallurgical aspects of crack-tip failure processes, 14:36590 (BA;US)
Specimen thickness effects for elastic-plastic CTOD toughness of an A36 steel, 14:36602 (BA;US)
Thermal strains in a bimaterial joint: Experimental and numerical analysis, 14:36586 (R;US)
Threshold-stress determination using tapered specimens and cyclic stresses, 14:35685 (BA;US)
STELLARATOR TYPE REACTORS
Transport survey calculations using the spectral collocation method, 14:37714 (R;US)
STELLARATORS
See also JIPPT-2 DEVICE
TORSATRON STELLARATOR
Impurity ion diffusion in stellaration-type traps, 14:37724 (RA;SU;In Russian)
STEMMING MATERIALS
Stemming temperature changes during emplacement: Experimental results and analysis, 14:36982 (R;US)
STES
See SEASONAL THERMAL ENERGY STORAGE
STIRLING ENGINES
NASA Lewis Stirling engine computer code evaluation, 14:36448 (R;US)

Research and development on a 3-kW-class Stirling engine, 14:36390 (R;JP)

STOCHASTIC PROCESSES
Long-time correlation for the chaotic orbit in the two-wave Hamiltonian, 14:37729 (R;JP)

STOCKS
See INVENTORIES

STOKERS
Report on the combustion of screened duff coal in a chain-grate stoker-fired boiler, 14:35590 (R;ZA)

STOMACH
Formation and prevention of destructive changes in mucous membranes of stomach of irradiated rats, 14:37360 (RA;SU;In Russian)

STORAGE (SPENT FUEL)
See SPENT FUEL STORAGE

STORAGE BATTERIES
See ELECTRIC BATTERIES

STORAGE BATTERIES (LEAD-ACID)
See LEAD-ACID BATTERIES

STORAGE DEVICES (DATA)
See MEMORY DEVICES

STORAGE RINGS
See also HERA STORAGE RING
LEP STORAGE RINGS
SUPERCONDUCTING SUPER COLLIDER
Automatic steering corrections to minimize injection oscillations in the Fermilab Antiproton Source rings, 14:37074 (R;US)

STOVES
Indoor spatial monitoring of combustion-generated pollutants (TSP, CO, and BAP) by Indian cookstoves, 14:37162 (R;US)

STRAIN GAGES
In search of more output: Two strain gage bridge circuits revisited, 14:37135 (R;US)

STRAINS
Noncontacting laser diffraction strain extensometer for material properties characterization at high temperatures, 14:36617 (R;US)

STRANGE BARYONS
See HYPERONS

STRANGE PARTICLES
See also HYPERONS
Strangeness production with antiprotons at LEAR, 14:37505 (R;US)

STRATA MOVEMENT
Data compilation report: strata deformation monitoring, No. 3 TBM tunnel, Donkin-Morien mine, N.S., 14:35567 (R;CA)

STREAMS
See also RIVERS
Aluminium dynamics in response to experimental additions of acid to a small Norwegian stream, 14:37266 (RA;NO)
Increased acidity and aluminium concentration in streams following afforestation: Causative mechanisms and processes, 14:37243 (RA;NO)
Modelling long term stream acidification trends in upland Wales, 14:37271 (RA;NO)

STREETS
See ROADS

STRESSES
See also THERMAL STRESSES
The PVF2 piezoelectric polymer shock stress sensor: System characterization for application under field test conditions, 14:36891 (R;US)

STRETFORD PROCESS
Stretford chemistry and analytical methods handbook. Topical report, 14:35675 (R;US)

STRING MODELS
Couplings in the heterotic superconformal three generation model, 14:37529 (R;DK)
Non renormalization theorem in bosonized n-string formalism, 14:37555 (R;DK)
Using reparametrization invariance to define vacuum infinities in string path integrals, 14:37559 (J;NL)

STRONTIUM
Sorption of radionuclides on London clay, 14:37224 (R;GB)

STRONTIUM 90
Combined effect of incorporated ^{90}Sr, alcohol, and tobacco smokes on reproduction of warm-blooded animals, 14:37372 (RA;SU;In Russian)
Dependence of animal life span shortening on dose rates in case of internal irradiation, 14:37369 (RA;SU;In Russian)
Modeling of combined effect of alcohol, tobacco smokes and internal irradiation of laboratory animals, 14:37375 (RA;SU;In Russian)
Morphological content of rat peripheral blood in combined effect of radiation factors, 14:37371 (RA;SU;In Russian)

STRONTIUM CHLORIDES
Physico-chemical study of extraction systems by the method of solubility diagrams (Solvent extraction and phase diagrams of strontium compounds.), 14:36830 (RA;SU)

STRONTIUM COMPLEXES
Mechanism of nitric acid and strontium extraction with zirconium di-2-ethylhexyl phosphate complexes-studying by the ^{14}N and ^{31}P NMR methods, 14:36837 (RA;SU)
New bis(grown ether)s as extraction agents, 14:36832 (RA;SU)
Physico-chemical study of extraction systems by the method of solubility diagrams (Solvent extraction and phase diagrams of strontium compounds.), 14:36830 (RA;SU)

STRONTIUM COMPOUNDS
See also STRONTIUM CHLORIDES
STRONTIUM OXIDES
Synthesis and study of some properties of mixed hexacyanoferrates (3) of rare alkali and alkaline-earth elements, 14:36789 (RA;SU;In Russian)

STRONTIUM OXIDES
X-ray absorption spectroscopy investigations of high Tc superconductors, 14:36649 (BA;US)

STRUCTURAL BUCKLING
See DEFORMATION

STRUCTURAL MATERIALS
See BUILDING MATERIALS

STRUCTURE (MOLECULAR)
See MOLECULAR STRUCTURE

STRUCTURES (BUILDINGS)
See BUILDINGS

STRUCTURES (MECHANICS)
See MECHANICAL STRUCTURES

STUDS
See FASTENERS

STYRENE
Health-hazard evaluation determination report No. 75-178-295, New York Telephone and Telegraph Company, 770 Broadway, New York, New York, 14:37183 (R;US)

SU GROUPS
New infinite-dimensional algebras, sine brackets, and SU (∞), 14:37545 (R;US)

SUBBITUMINOUS COAL
Alberta Research Council [research reports-1982], 14:35517 (R;CA)
Characterization and subsequent utilization of microbially solubilized coal: Preliminary studies, 14:35519 (R;US)
Development of an advanced process for drying fine coal in an inclined fluidized bed: Technical progress report for the second quarter, January 19–March 31, 1989, 14:35513 (R;US)

SUBCRITICAL FLOW
See LAMINAR FLOW

SUBURBS
See URBAN AREAS

SUCKER ROD PUMPS
See ROD PUMPS

SULFATES
See also CADMIUM SULFATES
CALCIUM SULFATES
CESIUM SULFATES
MAGNESIUM SULFATES
POTASSIUM SULFATES

PRASEODYMIUM SULFATES
SODIUM SULFATES
Effect of temperature and ionic impurities at very low concentrations on stress corrosion cracking of sensitized type 304 stainless steel, 14:36594 (BA;US)
Trajectory analysis of nine years of precipitation chemistry in Charlottesville, Virginia: Final report, 14:37165 (R;US)

SULFIDES
See also HYDROGEN SULFIDES
LEAD SULFIDES
LITHIUM SULFIDES
MOLYBDENUM SULFIDES
TITANIUM SULFIDES
ZINC SULFIDES
Petroleum sulfides, sulfoxides, and sulfones used as extragents (Solvent extraction of actinies, rare earths, transition metals.), 14:36839 (RA;SU)

SULFONIC ACIDS
Improved acid electrolytes: synthesis and structure of fluorine-containing sulfonic acids for fuel cells. Final report, July 1987-August 1988, 14:36363 (R;US)

SULFOX PROCESS
Stretford chemistry and analytical methods handbook. Topical report, 14:35675 (R;US)

SULFOXIDES
Petroleum sulfides, sulfoxides, and sulfones used as extragents (Solvent extraction of actinies, rare earths, transition metals.), 14:36839 (RA;SU)

SULFUR
Dynamic studies of deformation and fracture at grain boundaries, 14:36533 (BA;FR)
Experimental evidence of sulfur effect on the plane and on the extrinsic dislocations of a $\Sigma = 3$ grain boundary in nickel, 14:36504 (BA;FR)
Grain boundary chemistry contributions to intergranular hot cracking, 14:36513 (BA;FR)
Interfacial structure modifications induced by sulfur in Ag-Ni alloys, 14:36506 (BA;FR)
New ideas on interface structure from significant disagreements between experiments and prediction of interface composition in Ag base alloys, 14:36505 (BA;FR)
Segregation energies of phosphorus and sulfur in various relaxed structures of grain boundaries in Ni by tight-binding approximation, 14:36509 (BA;FR)
Structure and reactivity of chemisorbed species and reaction intermediates: Progress report, December 1, 1984–November 30, 1985, 14:36742 (R;US)
Testing of pyrite flotation techniques on selected Ohio coals: Final report, 14:35512 (R;US)
Unusual segregation behavior of boron and its effect on segregation of sulfur in nickel, 14:36508 (BA;FR)

SULFUR 32 REACTIONS
Multiplicity fluctuations in finite rapidity windows. Intermittency or quantum statistical correlation?, 14:37540 (J;NL)

SULFUR 32 TARGET
Isovector and isoscalar spin-flip excitations in even-even s-d shell nuclei excited by inelastic proton scattering, 14:37630 (R;FR)

SULFUR ADDITIONS
Interfacial structure modifications induced by sulfur in Ag-Ni alloys, 14:36506 (BA;FR)

SULFUR COMPOUNDS
See also SULFATES
SULFIDES
SULFUR OXIDES
Acidification and water pathways. What about the future?, 14:37273 (RA;NO)

SULFUR DIOXIDE
10-MW spray dryer/ESP pilot plant test program: High-sulfur coal test phase (phase 3): Final report, 14:35962 (R;US)
Design guidelines for a furnace sorbent injection waste management system: Final report, 14:35959 (R;US)
Development of a membrane SO_x/NO_x treatment system: Final report, 28 April 1987–28 April 1988, 14:35957 (R;US)
Effects of air pollutants on the composition of stable carbon isotopes $\delta^{13}C$, of leaves and wood, and on leaf injury, 14:37396 (J;US)
Errors in grab sample measurements of N_2O from combustion sources, 14:37197 (J;US)
Laboratory testing of a fluidized-bed dry-scrubbing process for the removal of acidic gases from a simulated incinerator flue gas: Final report, 14:36416 (R;US)
Measurement of SO_2 uptake and redistribution of sulfur in a pine canopy using ^{35}S, 14:35921 (J;US)
Modelling of sulphur dioxide capture in fluidized bed combustion, 14:35594 (R;SE)
National Performance Audit Program; ambient air audits of analytical proficiency, 1987, 14:37189 (R;US)
Ozone measurements near the ground and in the atmosphere in the first half-year 1988, 14:37170 (R;DE;In German)
Statistics on smoke and sulfur dioxide pollution in South Africa. Special report, 14:37187 (R;ZA)

SULFUR HYDRIDES
See HYDROGEN SULFIDES

SULFUR OXIDES
See also SULFUR DIOXIDE
5-MW Toronto HALT [Hydrate Addition at Low Temperature] pilot plant testing: Test results: Part 1-A, 14:35958 (R;US)

SULFUR SULFIDES
See SULFUR

SUN
Study of weak solar magnetic fields. Final report, 1 December 1987-30 November 1988, 14:37424 (R;US)

SUPERALLOYS
See HEAT RESISTING ALLOYS

SUPERCONDUCTING CABLES
Current capacity degradation in superconducting cable strands, 14:36940 (J;US)
Flux creep in a Tevatron cable, 14:36932 (J;US)
Manufacture and testing of 465 km superconducting cable for the HERA dipole magnets, 14:36919 (J;US)
Normal state resistance and low temperature magnetoresistance of superconducting cables for accelerator magnets, 14:36946 (J;US)
The effect of transverse stress on the critical current of Nb_3Sn cable-in-conduit superconductors, 14:36931 (J;US)
Training in test samples of superconducting cables for accelerator magnets, 14:36933 (J;US)

SUPERCONDUCTING COILS
Compacted 1-2-3 ceramic powders treated as superconducting composites, 14:36653 (J;US)
Considerations against a force compensated coil, 14:36935 (J;US)
Effects of insulation on potted superconducting coils, 14:36917 (J;US)
General formulas for the adiabatic propagation velocity of the normal zone, 14:36926 (J;US)
Influence of dump voltage and allowable temperature rise on stabilizer requirements in superconducting coils, 14:36927 (J;US)
Large coil task instrumentation and diagnostics, 14:36929 (J;US)
Optimization of multiwire coil ends having 45 degree bends, 14:36924 (J;US)
Standard-II and extended tests of the Swiss LCT-coil, 14:36915 (J;US)
Status of the SSC superconducting magnet program, 14:36910 (J;US)
The design of a high field Ohmic heating coil for a superconducting tokamak, based on the US-DPC test coil, 14:36907 (J;US)

SUPERCONDUCTING COMPOSITES
Anisotropies in the magnetic penetration depth and critical current density of $R_1Ba_2Cu_3O_{7-x}$ (R = Y or Ho), measured on magnetically-aligned powder composites, 14:36952 (J;US)
Compacted 1-2-3 ceramic powders treated as superconducting composites, 14:36653 (J;US)

SUPERCONDUCTING DEVICES
See also SQUID DEVICES
SUPERCONDUCTING MAGNETS

A superconducting cos 2θ quadrupole design for the CEBAF high resolution spectrometer, 14:36937 (J;US)
Superconducting Magnetic Energy Storage, 14:36895 (J;US)
Superconducting detector for minimum ionizing particles, 14:37123 (J;NL)
Superconductivity. Recent developments and defence applications (U), 14:36666 (R;CA)

SUPERCONDUCTING FILMS
A simple method for preparing superconducting high Tc thin films, 14:36956 (J;US)
Design of variable phase velocity kinetic inductance delay lines and their measured characteristics when fabricated by a simple Nb based process, 14:36904 (J;US)
Flux noise and flux creep in YBCO thin films, 14:36897 (J;US)
High-temperature superconductivity. Quarterly report No. 1 for period ending FY89, 14:36613 (R;US)
Hot electron effect in the dc SQUID, 14:36903 (J;US)
In situ growth of superconducting YBaCuO using reactive electron-beam coevaporation, 14:36955 (J;US)
Josephson effect research in high-temperature superconductors. Interim report, 30 September 1987-29 September 1988, 14:36609 (R;US)
Low frequency resistance fluctuations in films of high temperature superconductors, 14:36900 (J;US)
Rf properties of high-T_c superconductors, 14:36954 (J;US)
Single superconducting thin film devices for applications in high T_c materials circuits, 14:36898 (J;US)
Superconducting properties of magnetron sputtered high T_c thin films containing oxide compounds of yttrium, bismuth, or thallium, 14:36950 (J;US)

SUPERCONDUCTING JUNCTIONS
See also JOSEPHSON JUNCTIONS
Grain size control in powder processed $Y_1Ba_2Cu_3O_x$, 14:36947 (J;US)
Low contact-resistivity junctions to ceramic superconductors, 14:36945 (J;US)
Single superconducting thin film devices for applications in high T_c materials circuits, 14:36898 (J;US)

SUPERCONDUCTING MAGNETIC ENERGY STORAGE
A comparison of the conductor requirements for energy storage devices made with ideal coil geometries, 14:36928 (J;US)
Superconducting Magnetic Energy Storage, 14:36895 (J;US)
Thermal-hydraulic simulation of helium expulsion from a cable-in-conduit conductor, 14:36916 (J;US)

SUPERCONDUCTING MAGNETS
A superconducting dipole concept for the CEBAF high resolution spectrometers, 14:36943 (J;US)
A superconducting iron-dominated quadrupole for CEBAF, 14:36939 (J;US)
A superconducting toroidal magnet for the CEBAF large acceptance spectrometer, 14:36942 (J;US)
Advanced superconducting MHD magnet design for a retrofit power plant, 14:36918 (J;US)
An alternate method for designing dipole magnet ends, 14:36923 (J;US)
Ductility enhancement in unreacted internal-Sn Nb_3Sn through low-temperature anneals, 14:36948 (J;US)
Large coil task instrumentation and diagnostics, 14:36929 (J;US)
Magnet systems for the international thermonuclear experimental reactor, 14:36909 (J;US)
Magnetic field decay in model SSC dipoles, 14:36913 (J;US)
Measurement of internal forces in superconducting accelerator magnets with strain gauge transducers, 14:36911 (J;US)
Normal state resistance and low temperature magnetoresistance of superconducting cables for accelerator magnets, 14:36946 (J;US)
Studies of time dependence of fields in Tevatron superconducting dipole magnets, 14:36921 (J;US)
Superconducting super collider second generation dipole magnet cryostat design, 14:36922 (J;US)
Tests of full scale SSC R and D dipole magnets, 14:36912 (J;US)
Time variations of fields in superconducting magnets and their effects on accelerators, 14:36920 (J;US)

SUPERCONDUCTING QUANTUM INTERFERENCE DEVICES
See SQUID DEVICES

SUPERCONDUCTING SUPER COLLIDER
A conductor, with uncoupled 2.5 μm. diameter filaments, designed for the outer cable of SSC dipole magnets, 14:36938 (J;US)
An alternate method for designing dipole magnet ends, 14:36923 (J;US)
Beam-beam interaction and pacman effects in the SSC with random nonlinear multipoles, 14:37050 (R;US)
Current capacity degradation in superconducting cable strands, 14:36940 (J;US)
Measurement of internal forces in superconducting accelerator magnets with strain gauge transducers, 14:36911 (J;US)
Optimization of multiwire coil ends having 45 degree bends, 14:36924 (J;US)
SSC detector solenoid, 14:36925 (J;US)
Silicon PIN diode hybrid arrays for charged particle detection: Building blocks for vertex detectors at the SSC, 14:37119 (R;US)
Siting the superconducting super collider, 14:37033 (R;US)
Status of the SSC superconducting magnet program, 14:36910 (J;US)
Superconducting super collider second generation dipole magnet cryostat design, 14:36922 (J;US)
Test results from recent 1.8-M SSC model dipoles, 14:36908 (J;US)
Tests of full scale SSC R and D dipole magnets, 14:36912 (J;US)
Training in test samples of superconducting cables for accelerator magnets, 14:36933 (J;US)

SUPERCONDUCTING WIRES
A conductor, with uncoupled 2.5 μm. diameter filaments, designed for the outer cable of SSC dipole magnets, 14:36938 (J;US)
Ductility enhancement in unreacted internal-Sn Nb_3Sn through low-temperature anneals, 14:36948 (J;US)
Intermediate scale industrially processed Nb_3Sn(Ti) by powder metallurgy, 14:36941 (J;US)
Reaction kinetics of phase formation in Nb-Al powder metallurgy processed wire, 14:36944 (J;US)
Structural characteristics of proposed ITER TF coil conductor, 14:36930 (J;US)
The critical density throughout the superconducting phase of multifilamentary Nb_3Sn wire for forced flow fusion applications measured using the Bean-Campbell AC magnetization technique, 14:36951 (J;US)

SUPERCONDUCTIVITY
Bi-Ca-Sr-Cu-O superconductors, 14:36953 (J;US)
Evidence for phonon-mediated coupling in superconducting $Ba_{0.6}K_{0.4}BiO_3$, 14:36615 (R;US)
General formulas for the adiabatic propagation velocity of the normal zone, 14:36926 (J;US)
Superconducting properties of magnetron sputtered high T_c thin films containing oxide compounds of yttrium, bismuth, or thallium, 14:36950 (J;US)

SUPERCONDUCTORS
See also TYPE-II SUPERCONDUCTORS
A film transmission line resonator to measure the microwave surface resistance of $YBa_2Cu_3O_{7-x}$, 14:36901 (J;US)
Bi-Ca-Sr-Cu-O superconductors, 14:36953 (J;US)
Consolidation of powders of the oxide superconductor YBa_2Cu_3Ox by high energy-high rate processing, 14:36611 (R;US)
Impact of high temperature superconductors on the possibility of radio-frequency confinement, 14:36914 (J;US)
Ion beam modification and analysis of thin $YBa_2Cu_3O_7$ films, 14:36677 (R;DE)
Nondestructive testing for microelectronics, semiconductors, and superconductors. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:36993 (R;US)
Preparation of semiconductor cross sections by cleaving, 14:36686 (BA;US)

Structural characteristics of proposed ITER TF coil conductor, 14:36930 (J;US)
Superconductivity, critical current density, and magnetic properties of Fe-substituted $Y_1Ba_2(Cu_{1-x}Fe_x)_3O_z$ materials, 14:36949 (J;US)
Superconductivity. Recent developments and defence applications (U), 14:36666 (R;CA)
The effect of self field on the critical current determination of multifilamentary superconductors, 14:36936 (J;US)

SUPERCRITICAL FLOW
See TURBULENT FLOW

SUPERCRITICAL FLUID CHROMATOGRAPHY
Reverse micelles in supercritical fluid chromatography, 14:35644 (BA;US)

SUPERFLUID MODEL
Enlarged superfluid model of atomic nucleus, 14:37609 (R;XA)

SUPERFUND
Implementation of an integrated CERCLA-NEPA environmental process at a FUSRAP site, 14:37226 (R;US)
Summary report of capacity at commercial facilities. Volume 1. Summary report, 14:36435 (R;US)
Summary report of capacity at limited commercial and company-captive facilities. Volume 2. Draft report, 14:36437 (R;US)
Summary report of capacity at limited commercial and company-captive facilities. Volume 1. Draft report, 14:36436 (R;US)

SUPERGRANULATION
See SOLAR GRANULATION

SUPERNOVA REMNANTS
IUE observations of oxygen-rich supernova remnants, 14:37430 (RA;FR)

SUPERNOVAE
Spectral evolution of SN 1987A in the IUE long wavelength range, 14:37429 (RA;FR)

SUPERSYMMETRY
Couplings in the heterotic superconformal three generation model, 14:37529 (R;DK)
Wormholes and the cosmological constant, 14:37711 (J;NL)

SUPERVOLTAGE RADIOTHERAPY
See RADIOTHERAPY

SUPPORTS
See also POWERED SUPPORTS
Roofbolt support in board and pillar workings, 14:35576 (R;ZA)

SUPPORTS (CATALYST)
See CATALYST SUPPORTS

SURFACE COATING
See also ELECTRODEPOSITION
Impedance spectroscopy for the study of anodic copper dissolution in sulfuric acid in presence of benzotriazole, 14:36367 (BA;US)

SURFACE CONTAMINATION
Outline of the proposed radioecology study at the Maralinga Weapons Test site, 14:37643 (RA;AU)

SURFACE MINING
Proposal for the development of a computerized guidance system for the Easi-Miner continuous mining machine, 14:35571 (R;CA)
Statistical analysis of collected times between failure and times to repair of Easi-Miner at Obed Mine, 14:35569 (R;CA)
Survey of microprocessor based performance monitoring devices in Canadian surface coal and oil sands mines in 1987, 14:35572 (R;CA)

SURFACE WATERS
See also ESTUARIES
LAKES
STREAMS

Acidification
Acidification and water pathways. What about the future?, 14:37273 (RA;NO)
Acidification of infiltration waters as a result of the seepage through carboniferous host-rocks, 14:35566 (RA;NO)
Acidity of surface water in Norway, 14:37242 (RA;NO)
Alkalinity production in soil and rock: A useful concept for understanding acidification of soil and freshwater, 14:37259 (RA;NO)
Quality of surface water evolution during snowmelt. International symposium on acidification and water pathways, 14:37238 (RA;NO)
Use of representative field plots for the determination of hydrological flow-paths and associated hydrochemistry in studies of surface water acidification, 14:37261 (RA;NO)

Chemical Composition
Event studies and the interpretation of water quality in forested basin, 14:37245 (RA;NO)
Liming as a method to neutralize highly acidic drainage waters from sulphate basins in western Finland, 14:37247 (RA;NO)
Loch Fleet Project, 14:37244 (RA;NO)
Size distribution patterns for trace elements in waters draining a small catchment, S.E. Norway, 14:37263 (RA;NO)

Coal Mines
Acidification of infiltration waters as a result of the seepage through carboniferous host-rocks, 14:35566 (RA;NO)

Compiled Data
Quebec surface water data, 1987, 14:35873 (R;CA)

Ecology
Liming as a method to neutralize highly acidic drainage waters from sulphate basins in western Finland, 14:37247 (RA;NO)

Environmental Exposure Pathway
Alkalinity production in soil and rock: A useful concept for understanding acidification of soil and freshwater, 14:37259 (RA;NO)
Use of representative field plots for the determination of hydrological flow-paths and associated hydrochemistry in studies of surface water acidification, 14:37261 (RA;NO)

Forests
Event studies and the interpretation of water quality in forested basin, 14:37245 (RA;NO)
Hydrologic system characterisation for biogeochemical process research in forest ecosystems, 14:37236 (RA;NO)

Geochemistry
Hydrologic system characterisation for biogeochemical process research in forest ecosystems, 14:37236 (RA;NO)

Liming
Liming as a method to neutralize highly acidic drainage waters from sulphate basins in western Finland, 14:37247 (RA;NO)

Ph Value
Loch Fleet Project, 14:37244 (RA;NO)

Rock-Fluid Interactions
Alkalinity production in soil and rock: A useful concept for understanding acidification of soil and freshwater, 14:37259 (RA;NO)

Rocky Mountains
Processes affectin the chemistry of waters passing through a high elevator Sierra Nevada watershed, 14:37240 (RA;NO)

Site Surveys
Radiological survey of San Diego Bay, 14:37279 (R;US)

Snow
Quality of surface water evolution during snowmelt. International symposium on acidification and water pathways, 14:37238 (RA;NO)

Soils
Relation between water flow paths in the soil and runoff chemistry at Risdalsheia, a small headwater catchment in southern Norway, 14:37265 (RA;NO)
Use of representative field plots for the determination of hydrological flow-paths and associated hydrochemistry in studies of surface water acidification, 14:37261 (RA;NO)

Water Chemistry
Precipitaton, surface and subsurface water chemistry in a tolerant hardwood forest basin, 14:37262 (RA;NO)
Processes affectin the chemistry of waters passing through a high elevator Sierra Nevada watershed, 14:37240 (RA;NO)
Water chemistry/water discharge relationships within the Churchill River diversion and Lake Winnipeg regulation region, Manitoba, Canada, 14:35895 (R;CA)

Water Quality
Precipitaton, surface and subsurface water chemistry in a tolerant hardwood forest basin, 14:37262 (RA;NO)
Relation between water flow paths in the soil and runoff chemistry at Risdalsheia, a small headwater catchment in southern Norway, 14:37265 (RA;NO)

SURFACES
Effects of road condition on the operating costs of buses, 14:36406 (R;ZA)
Effects of road-surface properties on the fuel consumption of trucks and buses, 14:36405 (R;ZA)
Resonant charge-exchange studies with hyperthermal-energy ion beams: development of multi-detection capabilities and a data acquisition system. Final report, 15 November 1986-14 May 1988, 14:37460 (R;US)
Theoretical investigations of phonon anomalies in fcc La and W(001), 14:36603 (D;US)
SURRY POWER STATION UNIT-1
See SURRY-1 REACTOR
SURRY POWER STATION UNIT-2
See SURRY-2 REACTOR
SURRY-1 REACTOR
Phenomenological uncertainties in the suspended radionuclide concentrations in containment during severe LWR accidents, 14:36189 (BA;US)
SURRY-2 REACTOR
Nuclear regulation, 14:36146 (R;US)
SURVEILLANCE (MEDICAL)
See MEDICAL SURVEILLANCE
SUSPENSIONS
Stress in dilute suspensions, 14:37482 (R;US)
SUSPENSIONS (FUEL)
See FUEL SLURRIES
SUSQUEHANNA STEAM ELECTRIC STATION UNIT-1
See SUSQUEHANNA-1 REACTOR
SUSQUEHANNA STEAM ELECTRIC STATION UNIT-2
See SUSQUEHANNA-2 REACTOR
SUSQUEHANNA-1 REACTOR
Adult learning techniques in maintenance training, 14:35988 (RA;US)
SUSQUEHANNA-2 REACTOR
Adult learning techniques in maintenance training, 14:35988 (RA;US)
SWAMPS
High temperature flood injury of woody swamp seedlings, 14:35916 (J;US)
SWEDEN
A solar heating plant with heat pump and seasonal storage. System design influence on thermal performance and economy, 14:35936 (RA;CA;In English and French)
Ground heat technology in Sweden, 14:36200 (RA;CA;In English and French)
Postglacial faulting and paleoseismicity in the Landsjaerv area, northern Sweden, 14:37414 (R;SE)
Seasonal storage of heat for district heating in Sweden, 14:36206 (RA;CA;In English and French)
SWITCHES
See also PLASMA SWITCHES
Explosively formed fuse opening switches for use in flux-compression generator circuits, 14:37007 (R;US)
Jitter improvement of the 12-MV oil switches on Aurora, 14:36882 (R;US)
SWITZERLAND
The Vaulruz project experimental results, 14:35933 (RA;CA;In English and French)
SYMMETRY BREAKING
First evidence for direct cp violation, 14:37544 (R;FR)
SYMPOSIA
See MEETINGS
SYNCHROPHASOTRONS
See SYNCHROTRONS
SYNCHROTRON RADIATION SOURCES
Synchrotron light source data book, 14:37030 (R;US)
SYNCHROTRONS
See also CERN SPS SYNCHROTRON
FERMILAB ACCELERATOR
FERMILAB TEVATRON
ITEP SYNCHROTRON
ORSAY SYNCHROTRON
A compact x-ray lithography lattice using superferric magnets, 14:37034 (R;US)
Comparison of analytical and computational estimates of reduction in linear aperture in the presence of sextupole field, 14:37047 (R;US)
SYNCRUDE
See SYNTHETIC PETROLEUM
SYNTHETIC CRUDE OIL
See SYNTHETIC PETROLEUM
SYNTHETIC FUELS
See also SYNTHETIC PETROLEUM
Fuels from microalgae, 14:35910 (R;US)
SYNTHETIC FUELS REFINERIES
Cool Water Coal Gasification Program: Monitoring Review Committee meeting report, Washington, D.C., July 12, 1988, 14:35540 (R;US)
SYNTHETIC PETROLEUM
Syncrude processing in conventional refineries, 14:35704 (RA;CA)
The Husky bi-provincial upgrader design basis, 14:35727 (RA;CA)
SYNTHINE PROCESS
See FISCHER-TROPSCH SYNTHESIS

T

T CODES
Neutrons and gamma transport in atmosphere by Tripoli-2 code. Energy deposit and electron current time function, 14:37156 (R;FR;In French)
T3 HORMONE
See TRIIODOTHYRONINE
T4 HORMONE
See THYROXINE
TANDEM MIRRORS
AMBAL-YU experiment, 14:37725 (RA;SU;In Russian)
TANTALUM ALLOYS
Evolution of the chemistry of passive films of sputter-deposited, supersaturated Al alloys. Annual report, 1 July 1987-30 November 1988, 14:36461 (R;US)
TANTALUM COMPLEXES
Metal extraction by amides of carboxylic acids, 14:36719 (RA;SU)
TANTALUM OXIDES
Phase relationships in high-temperature ceramics. Phase 1. Final report, 14:36610 (R;US)
Regularities of structure and properties of mixed oxides of the composition $ABTeO_6$ (A-K, Rb, Cs, Tl; B-Nb, Ta, Sb), 14:36795 (RA;SU;In Russian)
Thermogravimetric study of formation process and properties of cesium tantalum oxides, 14:36772 (RA;SU;In Russian)
TAR SAND OIL
See BITUMENS
TAR SAND TAILINGS
See OIL SAND TAILINGS
TAR SANDS
See OIL SANDS
TARGETS
See also ALUMINIUM 27 TARGET
ARGON 40 TARGET
BERYLLIUM 9 TARGET
BISMUTH 209 TARGET
CARBON 12 TARGET
CARBON 13 TARGET
CHROMIUM 52 TARGET
COBALT 59 TARGET
DEUTERIUM TARGET
DYSPROSIUM 161 TARGET
GALLIUM 71 TARGET
GOLD 197 TARGET
HELIUM 3 TARGET
HYDROGEN 1 TARGET
IRON 56 TARGET
LEAD 207 TARGET

LITHIUM 7 TARGET
MAGNESIUM 24 TARGET
MAGNESIUM 26 TARGET
MOLYBDENUM 100 TARGET
MOLYBDENUM 92 TARGET
NICKEL 60 TARGET
NITROGEN 12 TARGET
OXYGEN 16 TARGET
OXYGEN 18 TARGET
POLARIZED TARGETS
SILICON 28 TARGET
SULFUR 32 TARGET
THORIUM 232 TARGET
TIN 124 TARGET
TRITIUM TARGET
URANIUM 235 TARGET
URANIUM 236 TARGET
URANIUM 238 TARGET
ZINC 68 TARGET
ZIRCONIUM 90 TARGET
ZIRCONIUM 91 TARGET
ZIRCONIUM 92 TARGET
ZIRCONIUM 94 TARGET
Decay of doubly-odd nucleus ^{184}Ir, 14:37594 (R;FR)

TASK SCHEDULING
Hanford Site implementation of the National Environmental Policy Act: Activities tracking, 14:37276 (R;US)

TBP
Determination of thermodynamic characteristics of extraction equilibria in the systems containing ammonium salts and organic phosphorus compounds (Solvent extraction of nitrates of Ce, Pr, Eu, UO_2^{2+}, Th.), 14:36717 (RA;SU)
Extraction properties of TBP - uranyl nitrate disolvate, 14:36718 (RA;SU)
Hydration and solvation energies and thermodynamic distribution coefficient of some extraction systems (Extraction systems: TBP-UO_2Cl_2($ThCl_4$)-HCL; AA-$InCl_3$-HCl, where AA-acetylacetone.), 14:36825 (RA;SU)
Mechanism of extraction of uranium (6) by mixtures of phosphorganic extractants, 14:36864 (RA;SU)

TECHNOLOGY IMPACTS
Advanced ceramics in Brazil: actual stage and perspectives, 14:36635 (R;BR;In Portuguese)

TECHNOLOGY TRANSFER
Marketing for Oak Ridge technology transfer, 14:36242 (R;US)
Providing incentives for effective technology transfer, 14:36246 (J;US)

TELEVISION
TV interference study on distribution test line, 14:35974 (R;CA)

TELLURIDES
See also ZINC TELLURIDES
Permittivity relaxation in $Pb_{1-x}Ge_xTe$, 14:36558 (RA;SU;In Russian)

TELLURIUM 125
Magnetic moments of low-lying states in ^{103}Rh, ^{111,113}Cd, and ^{123,125}Te, 14:37590 (J;US)

TELLURIUM OXIDES
Physicochemical study of interaction in the systems Li_2O-TeO_2-M_nO_m (M-Cr, Mo, Ti; n=1.2; m=2.3), 14:36762 (RA;SU;In Russian)
Regularities of structure and properties of mixed oxides of the composition $ABTeO_6$ (A-K, Rb, Cs, Tl; B-Nb, Ta, Sb), 14:36795 (RA;SU;In Russian)

TEMPERATURE DEPENDENCE
Analysis of alternative waste isolation concepts, 14:35795 (R;US)

TEMPERATURE MEASUREMENT
On the question of nonconsumable electrode measuring of temperature in the process of argon-arc welding, 14:36564 (RA;SU;In Russian)

TENNESSEE VALLEY AUTHORITY
Office of the Inspector General: Semiannual report, October 1, 1988–March 31, 1989, 14:37793 (R;US)

TERBIUM COMPLEXES
Effect of cesium ions on character of solubility and rare earth formate complexing processes, 14:36778 (RA;SU;In Russian)

TERBIUM COMPOUNDS
See also TERBIUM OXIDES
Effect of cesium ions on character of solubility and rare earth formate complexing processes, 14:36778 (RA;SU;In Russian)

TERBIUM OXIDES
Investigation of the lanthanide sesquioxides as high temperature transformation toughening agents, 14:36648 (B;US)

TERNARY ALLOY SYSTEMS
Application of quaternary phase diagrams to compound semiconductor processing: Progress report, April 1–December 31, 1988, 14:36480 (R;US)

TERPENES
Development of radioimmunological methods to determine the constituents of nicotiana plants and cell cultures, 14:37299 (R;DE;In German)

TERRESTRIAL BACKGROUND
See BACKGROUND RADIATION

TERRESTRIAL ECOSYSTEMS
See also SWAMPS
[International workshop on terrestrial field testing of pesticide, Cambridge, United Kingdom, September 11–16, 1988]: Foreign trip report, 14:37335 (R;US)

TERTIARY RECOVERY
See ENHANCED RECOVERY

TETRAHYMENA
Molecular basis of RNA catalysis. Annual report, March 1988-February 1989, 14:37301 (R;US)

TEVATRON
See FERMILAB TEVATRON

TEXAS
Nuclear waste package container corrosion in simulated salt repository environments, 14:35819 (BA;US)

TEXTILE INDUSTRY
Further studies of respiratory health of wool textile workers. Final report, October 1986-July 1988, 14:37191 (R;GB)

THALLIUM COMPOUNDS
See also THALLIUM NITRATES
THALLIUM OXIDES
Diamagnetic shielding and flux creep in a Tl-Ba-Ca-Cu-O thin film, 14:36584 (R;US)

THALLIUM NITRATES
Thermographic and X-ray diffraction study of binary systems based on rare alkali metal and thallium (1) nitrates and conditions of solid solution formation in them (Alkali metals: Li-Cs.), 14:36787 (RA;SU;In Russian)

THALLIUM OXIDES
Annealing and strain effects on Tl-Ba-Ca-Cu-O crystals and ceramics, 14:36647 (R;US)

THERMAL ANALYSIS
A synopsis of analyses (1981–87) performed to assess the stability of underground excavations at Yucca Mountain: Yucca Mountain Project, 14:35808 (R;US)

THERMAL COMFORT
Thermal environment evaluation, 14:36394 (R;CA;In French and English)

THERMAL CONDUCTIVITY
Thermal conductivity of rock and soil, 14:36203 (RA;CA;In English and French)

THERMAL DECOMPOSITION
See PYROLYSIS

THERMAL EFFLUENTS
Plankton studies at Sequoyah Nuclear Plant in 1988, 14:36111 (R;US)

THERMAL ENERGY STORAGE EQUIPMENT
Development of heat storage systems with vertical pipes in earth and rock, 14:36207 (RA;CA;In English and French)
Energy storage by adsorption of water on zeolite for building heating, 14:36211 (RA;CA;In English and French)

THERMAL INSULATION
Contamination of reflective foils in horizontal applications and its effect on thermal performance, 14:36375 (R;US)

THERMAL NEUTRONS
Neutron transmission of single crystal MgO filters, 14:37097 (J;NL)

THERMAL PHOTOGRAPHY
See INFRARED THERMOGRAPHY

THERMAL POLLUTION (AIR)
See AIR POLLUTION

THERMAL POLLUTION (WATER)
See WATER POLLUTION

THERMAL REACTORS
See also AFRRI REACTOR
ATR REACTOR
BSR-1 REACTOR
BSR-2 REACTOR
BELLEFONTE-1 REACTOR
BELLEFONTE-2 REACTOR
CANDU TYPE REACTORS
CHERNOBYLSK-4 REACTOR
HIFAR REACTOR
OYSTER CREEK-1 REACTOR
SEABROOK-2 REACTOR
SEQUOYAH-1 REACTOR
SEQUOYAH-2 REACTOR
SHIPPINGPORT REACTOR
SOUTH TEXAS PROJECT-1 REACTOR
SOUTH TEXAS PROJECT-2 REACTOR
SURRY-1 REACTOR
SURRY-2 REACTOR
SUSQUEHANNA-1 REACTOR
SUSQUEHANNA-2 REACTOR
THREE MILE ISLAND-1 REACTOR
THREE MILE ISLAND-2 REACTOR
VERMONT YANKEE REACTOR
WWER TYPE REACTORS
WATTS BAR-1 REACTOR
WATTS BAR-2 REACTOR
[International conference on Thermal reactor safety, October 2-7, 1988, Avignon, France]: Foreign trip report, 14:36167 (R;US)

THERMAL RECOVERY
Corrosion problems and experience at AOSTRA in-situ thermal recovery pilots, 14:36468 (RA;CA)
Gravel pack equipment requires special design for thermal recovery, 14:35626 (RA;CA)
Mobil Oil Canada's use of insulated tubulars in thermal projects, 14:35724 (RA;CA)
Thermal completions for radial production systems, 14:35625 (RA;CA)
Thermal well completions seminar, 14:35722 (R;CA)

THERMAL SHIELDS
Thermal conduction of high-temperature steel foil shield for HTGR reactor, 14:36017 (RA;SU;In Russian)

THERMAL STORAGE
See HEAT STORAGE

THERMAL STRESSES
Effect of peak thermal strain on simplified ratchetting analysis procedures, 14:36084 (R;US)

THERMIONIC DIODES
Compound-lens diode for HERMES III, 14:37092 (R;US)
Ion diode experiments on PBFA [Particle Beam Fusion Accelerator] II: Workshop on applications of high power switching, 14:37780 (R;US)
MHD calculations of anode plasmas, 14:37483 (R;US)

THERMOCHEMICAL HEAT STORAGE
Analysis of a thermochemical energy storage system with liquid absorbents, 14:36217 (RA;CA;In English and French)

THERMONUCLEAR REACTIONS
See also MUON-CATALYZED FUSION
To the problem of thermal stability of a stellarator reactor, 14:37764 (RA;SU;In Russian)

THERMONUCLEAR REACTOR MATERIALS
Fusion reactor materials semiannual progress report for the period ending September 30, 1988, 14:37759 (R;US)

THERMONUCLEAR REACTORS
See also STELLARATOR TYPE REACTORS
TOKAMAK TYPE REACTORS
Canadian contributions to the safety and environmental aspects of fusion, 14:37757 (R;CA)
Controlled thermonuclear fusion in TOKAMAK type reactors, the European example: Joint European Torus (JET), 14:37763 (R;BR;In Portuguese)
Internal shielding of thermonuclear reactors, 14:37766 (RA;SU;In Russian)
Large coil task instrumentation and diagnostics, 14:36929 (J;US)
Neutronics analysis for aqueous self-cooled fusion reactor blankets, 14:37756 (R;CA)
Structural characteristics of proposed ITER TF coil conductor, 14:36930 (J;US)
Thermonuclear synthesis. Scientific-technical collection, 14:37712 (R;SU;In Russian)

THERMONUCLEAR WEAPONS
See NUCLEAR WEAPONS

THERMOSPHERE
Global density specification in the lower thermosphere. Final report, 15 June 1985-17 June 1988, 14:37448 (R;US)

THIN FILMS
Composition and structure of the passive oxide film on iron as observed by second harmonic generation, 14:36650 (BA;US)
Cross-sectioning magnetic thin films for TEM, 14:36685 (BA;US)
Effect of noble gases on the properties of ion-beam-sputtered niobium films, 14:36465 (R;US)
Measurements of the structure and dynamics of thin film growth on electrode surfaces by SHG, 14:36369 (BA;US)

THIO COMPOUNDS
See ORGANIC SULFUR COMPOUNDS

THIOBACILLUS FERROXIDANS
Electrochemistry of thiobacillus ferrooxidans reactions with pyrite: Technical progress report, January 15–April 15, 1989, 14:35528 (R;US)
Respiratory enzymes of Thiobacillus ferrooxidans: Progress report, March 1988–July 1989, 14:37325 (R;US)

THIOETHERS
See SULFIDES

THIOPHENE
Deactivation of hydrotreatment catalysts used for coal liquids: Semi-annual report, 12 May 1988–11 November 1988, 14:35525 (R;US)

THOMAS-FERMI MODEL
Ionization equilibrium in dense plasmas, 14:37748 (D;US)

THOMAS-FERMI-DIRAC MODEL
See THOMAS-FERMI MODEL

THORIUM 230
$^{230}Th/^{234}U$ dating of the quaternary spring travertines in the Arava Rift Valley of Israel and paleoclimatic implications. Final report for the period 15 December 1986 - 15 December 1987, 14:37405 (R;XA)

THORIUM 232 TARGET
Ionization chamber-detecting setup of Vasilisa installation for the study of characteristics of total fusion reaction product decay, 14:37115 (R;SU;In Russian)
Multiplicity of neutrons from violent heavy-ion collisions: ^{40}Ar + Th and U from 10 to 77 MeV/u, 14:37603 (R;DE)

THORIUM COMPLEXES
Determination of thermodynamic characteristics of extraction equilibria in the systems containing ammonium salts and organic phosphorus compounds (Solvent extraction of nitrates of Ce, Pr, Eu, UO_2^{2+}, Th.), 14:36717 (RA;SU)
Extraction properties of TBP - uranyl nitrate disolvate, 14:36718 (RA;SU)
Hydration and solvation energies and thermodynamic distribution coefficient of some extraction systems (Extraction systems: TBP-UO_2Cl_2($ThCl_4$)-HCL; AA-$InCl_3$-HCl, where AA-acetylacetone.), 14:36825 (RA;SU)
Ir, NMR and conductivity study of extracts and the character of the mutual influence of metals in their extraction with alkylammonium salts, 14:36716 (RA;SU)

THORIUM COMPOUNDS
On thorium and plutonium cocrystallization with calcium oxalate, 14:37356 (RA;SU;In Russian)
THREE MILE ISLAND-1 REACTOR
Team skills training: the critical next step at GPU Nuclear, 14:35985 (RA;US)
THREE MILE ISLAND-2 REACTOR
Fission product behaviour during the TMI-2 accident, 14:36190 (BA;US)
Radionuclide distribution in TMI-2 reactor building basement liquids and solids, 14:36193 (BA;US)
Results of surface activity and radiation field measurements made during surface decontamination experiments conducted at TMI-2, 14:36194 (BA;US)
TMI-2 core debris analytical methods and results, 14:36191 (BA;US)
TMI-2 leadscrew radionuclide deposition and characterization, 14:36192 (BA;US)
THREE-BODY PROBLEM
Adiabatic representation of scattering problem in three-body quantum system, 14:37705 (R;SU;In Russian)
THYROID STIMULATING HORMONE
See TSH
THYROXINE
Israel EQAS for thyroid related hormones. Final report for the period June 1984 - February 1988, 14:37316 (R;XA)
TIDAL POWER PLANTS
Generic steel designs for tidal power barrages. V. 1, pt. 1, 14:35950 (R;GB)
Generic steel designs for tidal power barrages. V. 1, pt. 2, 14:35951 (R;GB)
Prediction of post barrage densities of shorebirds. V. 1. Overview, 14:35947 (R;GB)
Prediction of post barrage densities of shorebirds. V. 3. Invertebrates, 14:35946 (R;GB)
Prediction of post barrage densities of shorebirds. V. 4. Birds, 14:35945 (R;GB)
River Loughor tidal power scheme. A feasibility study report, 14:35949 (R;GB)
Wader migration and distribution in South West estuaries (in relation to the Severn Barrage). V. 1, 14:35948 (R;GB)
Wader migration and distribution in South West estuaries. V. 2. Appendices, 14:35944 (R;GB)
TIGHT SANDS
See PERMEABILITY
SANDSTONES
TIN
A test system for thermomechanical fatigue of solder joints, 14:36585 (R;US)
New ideas on interface structure from significant disagreements between experiments and prediction of interface composition in Ag base alloys, 14:36505 (BA;FR)
Observations on the mechanisms of fatigue in eutectic Pb-Sn solder joints, 14:36574 (R;US)
TIN 124 TARGET
Neutron emission and nuclear spin distribution in 4n and 5n exit channels of the ^{156}Dy compound nucleus, 14:37586 (R;FR)
TIN ALLOYS
See also TIN BASE ALLOYS
Cyclic migration and fracture in solid solution alloys, 14:36988 (BA;FR)
Intermediate scale industrially processed Nb_3Sn(Ti) by powder metallurgy, 14:36941 (J;US)
TIN BASE ALLOYS
Neutron diffraction study of crystal structure of K_2Sn_3, Rb_2Sn_3, and Cs_2Sn_3, 14:36547 (RA;SU;In Russian)
TITANIUM
Dynamic studies of deformation and fracture at grain boundaries, 14:36533 (BA;FR)
Effect of construction of current and gas supply on protective atmosphere composition in welded installation, 14:36565 (RA;SU;In Russian)
Introduction of experience of television information-control systems in welding, 14:36569 (RA;SU;In Russian)
TITANIUM ALLOYS
See also TITANIUM BASE ALLOYS
Current capacity degradation in superconducting cable strands, 14:36940 (J;US)
Flux creep in a Tevatron cable, 14:36932 (J;US)
Noncontacting laser diffraction strain extensometer for material properties characterization at high temperatures, 14:36617 (R;US)
TITANIUM BASE ALLOYS
An Auger sputter profiling study of nitrogen and oxygen ion implantation in two titanium alloys, 14:37688 (R;US)
Diffusion at explosion welding of titanium with steel, 14:36568 (RA;SU;In Russian)
TITANIUM COMPOUNDS
See also TITANIUM OXIDES
TITANIUM SULFIDES
Fundamental magnetic studies of iron-rare-earth-metalloid alloys: Technical performance report, 14:36483 (R;US)
TITANIUM OXIDES
Structure and properties of nanophase TiO_2, 14:36534 (BA;FR)
TITANIUM SULFIDES
Staging in layer intercalates: Progress report, 1 June 1988–31 May 1989, 14:36667 (R;US)
TOA
Thermodynamics of solvent extraction on $(C_8H_{17})_3N$-$C_6H_5CH_3$-UO_2Cl_2-HCl system, 14:36860 (RA;SU)
TOKAMAK DEVICES
See also COMPACT IGNITION TOKAMAK
ITER TOKAMAK
JIPPT-2 DEVICE
TORE SUPRA TOKAMAK
TUMAN DEVICES
Determination of magnetic field direction in tokamaks from laser-induced Lyman-α fluorescence, 14:37717 (R;FR)
Multiple mode model of tokamak transport, 14:37740 (R;US)
Review of effects of NBI [neutral beam injection] and rotation on plasma transport in tokamaks, 14:37720 (R;US)
Tokamak electrical conductivity modified by electrostatic trapping in the applied electric field, 14:37741 (R;US)
Turbulence and abnormal transport in tokamak plasmas, 14:37718 (R;FR;In French)
TOKAMAK TYPE REACTORS
See also COMPACT IGNITION TOKAMAK
JT-60 TOKAMAK
Atomic physics studies of highly charged ions on tokamaks using x-ray spectroscopy, 14:37738 (R;US)
TOLUENE
Containment of organic leachates from leaking underground storage tanks using tailored soils as liners, 14:37216 (R;US)
Macromolecular coal structure as revealed by novel diffusion tests: Quarterly technical report, January 15, 1989–April 15, 1989, 14:35553 (R;US)
TOPO
Mechanism of extraction of uranium (6) by mixtures of phosphororganic extractants, 14:36864 (RA;SU)
TOPPING CYCLES
MHD Integrated Topping Cycle Project: Quarterly progress report, 30 September–31 October 1987, 14:36346 (R;US)
MHD Integrated Topping Cycle Project: Third quarterly progress report, 1 February–30 April 1988, 14:36347 (R;US)
MHD [Magnetohydrodynamics] Integrated Topping Cycle Project: Second quarterly technical progress report, November 1, 1987–January 31, 1988, 14:36348 (R;US)
TORE SUPRA
See TORE SUPRA TOKAMAK
TORE SUPRA TOKAMAK
Plugging regime in the pump limiter throat, 14:37719 (R;FR)
Tore Supra first wall description and behaviour during the initial plasma experiments, 14:37760 (R;FR)
TORSATRON STELLARATOR
See also ATF TORSATRON
Alpha-particle losses in compact torsatron reactors, 14:37715 (R;US)

TOTAL SUSPENDED PARTICULATES
Indoor spatial monitoring of combustion-generated pollutants (TSP, CO, and BAP) by Indian cookstoves, 14:37162 (R;US)
TOTAL-ABSORPTION SPECTROMETERS
See SHOWER COUNTERS
TOWERS (EXTRACTION)
See EXTRACTION COLUMNS
TOXIC MATERIALS
See also TOXINS
AQUIRE: Aquatic Toxicity Information Retrieval data base. Data file, 14:37275 (R;US)
Health-hazard evaluation determination report No. 75-151-259, Winchester Hospital, Winchester, Massachusetts, 14:37184 (R;US)
Reporting for the domestic substances list, 14:36232 (R;CA;In French)
The preparation of TEM specimens from hazardous or difficult materials, 14:36681 (BA;US)
TOXICITY
1988 DOE model conference proceedings: Volume 5, 14:35775 (R;US)
AQUIRE: Aquatic Toxicity Information Retrieval data base. Data file, 14:37275 (R;US)
TOXINS
Characterization of chemically tritiated microcystin-Lr and its distribution in mouse. Interim report, 14:37328 (R;US)
TRACE ELEMENTS
See ELEMENTS
TRACK DETECTORS (DIELECTRIC)
See DIELECTRIC TRACK DETECTORS
TRADE
Energy analysis of Canadian external trade, 1971 and 1976, 14:36227 (R;CA;In English and French)
TRAINING
Implementing requirements for radiation worker training from DOE Order 5480.11, 14:35754 (R;US)
TRANSDUCERS
Measurement of internal forces in superconducting accelerator magnets with strain gauge transducers, 14:36911 (J;US)
TRANSFER (ELECTRON)
See ELECTRON TRANSFER
TRANSFER (HEAT)
See HEAT TRANSFER
TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION
TRANSFORMER OILS
See INSULATING OILS
TRANSFORMERS
Effect of oil viscosity on transformer loading capability at ambient temperatures below 0^0C, 14:35972 (R;CA)
Electromagnetic transients program (EMTP): Volume 3, Workbook III: Final report, 14:35954 (R;US)
High voltage power condition systems powered by flux compression generators, 14:37005 (R;US)
High-voltage pulsed transformer development, 14:37009 (R;US)
TRANSIENTS
Electromagnetic transients program (EMTP): Volume 3, Workbook III: Final report, 14:35954 (R;US)
TRANSISTORS
See also MOS TRANSISTORS
Photocurrent variability of discrete bipolar devices, 14:37017 (R;US)
TRANSITION ELEMENT COMPLEXES
See also CHROMIUM COMPLEXES
COBALT COMPLEXES
HAFNIUM COMPLEXES
MOLYBDENUM COMPLEXES
NIOBIUM COMPLEXES
RHENIUM COMPLEXES
RHODIUM COMPLEXES
RUTHENIUM COMPLEXES
SCANDIUM COMPLEXES
TANTALUM COMPLEXES
TUNGSTEN COMPLEXES
VANADIUM COMPLEXES
YTTRIUM COMPLEXES
ZIRCONIUM COMPLEXES
Petroleum sulfides, sulfoxides, and sulfones used as extragents (Solvent extraction of actinies, rare earths, transition metals.), 14:36839 (RA;SU)
Size-selective extraction of metal salts: the general principles (Metals: alkali, alkaline earth, rare earth, transition elements, actinides.), 14:36831 (RA;SU)
TRANSITIONS (ENERGY LEVEL)
See ENERGY-LEVEL TRANSITIONS
TRANSLATORS
Approaching distributed database applications using a programmable terminal emulator, 14:37819 (R;US)
TRANSMISSION (DATA)
See DATA TRANSMISSION
TRANSMISSION (HEAT)
See HEAT TRANSFER
TRANSMISSION LINES
See POWER TRANSMISSION LINES
TRANSPORT
See also MARITIME TRANSPORT
VAM2D–Variably saturated analysis model in two dimensions: Version 5.0 with hysteresis and chained decay transport: Documentation and user's guide, 14:35793 (R;US)
TRANSPORT (NEUTRON)
See NEUTRON TRANSPORT
TRANSPORT (PROTON)
See PROTON TRANSPORT
TRANSPORT (RADIATION)
See RADIATION TRANSPORT
TRANSPORT INSURANCE
See INSURANCE
TRANSPORTATION SECTOR
Electronic communication and data transfer productivity enhancements, 14:37800 (R;US)
TRANSPORTATION SYSTEMS
See also BUSES
MASS TRANSIT SYSTEMS
RAPID TRANSIT SYSTEMS
General economic stimulation and energy indicators for capital investment initiatives in various transportation modes, 14:36229 (R;CA)
TRANSPOSONS
DNA modification of Mu elements in maize, 14:37313 (RA;US)
Effect of temperature on Ty transposition, 14:37295 (RA;US)
Effects of DNA damage on transcription and transposition of Ty retrotransposons of yeast, 14:37386 (RA;US)
Evidence of host-mediated regulation of retroviral element expression at the posttranscriptional level, 14:37312 (RA;US)
Factors affecting retrotransposition of intracisternal A-particle proviral elements, 14:37289 (RA;US)
Genes that affect Ty-mediated gene expression in yeast, 14:37309 (RA;US)
Induction of VL30 element expression as a response to anoxic stress, 14:37388 (RA;US)
Molecular basis of transposable element-induced mutations in Drosophila melanogaster, 14:37308 (RA;US)
Mutation induction by MR(P) and its modification by various conditions, 14:37341 (RA;US)
Possible role of retrotransposons in carcinogenesis, 14:37389 (RA;US)
Regulation of expression and transposition of murine endogenous retroviral elements, 14:37292 (RA;US)
Regulation of the maize suppressor-mutator element, 14:37287 (RA;US)
Regulation of yeast Ty element transposition, 14:37310 (RA;US)
Regulatory aspects of the expression of P-M hybrid dysgenesis in Drosophila, 14:37294 (RA;US)
Role of the bacterial host in the mechanism and regulation of Tn10 transposition, 14:37304 (RA;US)
SOS mutagenesis and replisome reactivation in bacteria: options acquired by transposition?, 14:37340 (RA;US)

Structure of mutations induced by I-R hybrid dysgenesis in Drosophila melanogaster, 14:37311 (RA;US)
Transposons as probes of regulatory machinery, 14:37291 (RA;US)
What transposable elements do in bacteria, 14:37286 (RA;US)

TRANSURANIUM ELEMENTS
See also NEPTUNIUM
PLUTONIUM
TRIFID [TRansuranic Isotopic Fraction Interrogation Device]: A second generation plutonium isotopic analysis system, 14:35843 (R;US)

TRANSURANIUM WASTES
See ALPHA-BEARING WASTES

TREES
See also CEDARS
PINES
Free life history strategies, 14:35922 (J;US)
Gas exchange characteristics of Pinus edulis and Juniperus monosperma, 14:35917 (J;US)
Net throughfall chemistry and atmospheric deposition at two forests of different elevations, 14:35924 (J;US)
Theory and methodology of single tree volume estimation, 14:35907 (R;CA;In English and French)

TRIBUTYL PHOSPHATE
See TBP

TRICHLOROMETHANE
See CHLOROFORM

TRIGA TYPE REACTORS
See also AFRRI REACTOR
Calculation analysis of TRIGA MARK II reactor core composed of two types of fuel elements. Final report for the period 1 August 1984 - 31 July 1986, 14:36115 (R;XA)

TRIGA-F-DASA REACTOR
See AFRRI REACTOR

TRIGGER CIRCUITS
An Outstanding Junior Investigator Award in experimental high energy physics: Progress report, January 1, 1989 to December 31, 1989, 14:37102 (R;US)

TRIIODOTHYRONINE
Israel EQAS for thyroid related hormones. Final report for the period June 1984 - February 1988, 14:37316 (R;XA)

TRINIDAD AND TOBAGO
The effects of well completion, steam injection and production practices on heavy oil production performance, 14:35613 (RA;CA)

TRIOCTYLAMINE
See TOA

TRIOCTYLPHOSPHINE OXIDE
See TOPO

TRIPLET PARTICLES
See QUARKS

TRITIATED COMPOUNDS
See TRITIUM COMPOUNDS

TRITIUM
An efficient palladium isotope chromatograph (EPIC) for hydrogen, 14:36727 (R;US)
Canadian contributions to the safety and environmental aspects of fusion, 14:37757 (R;CA)
Catalytic properties of hydride-forming intermetallic compounds in reactions with the participation of hydrogen, 14:36814 (RA;SU;In Russian)
Characterization of chemically tritiated microcystin-Lr and its distribution in mouse. Interim report, 14:37328 (R;US)
Kinetics of the gas phase tritium oxidation reaction, 14:36849 (R;US)
Substantiation of rate setting of surface contamination with amino acids, labelled with tritium, 14:37362 (RA;SU;In Russian)
Tritium labeling by thermally generated tritons, 14:36845 (R;US)

TRITIUM COMPOUNDS
Field studies of HT oxidation and dispersion in the environment. I. The 1986 August experiment at Chalk River, 14:37225 (R;CA)
Radiobiological effects of fractionated intake of ^{3}H-nucleosides by mammalian organism, 14:37368 (RA;SU;In Russian)

TRITIUM TARGET
Evaluation of total interaction cross-sections for nuclei with mass number 3, 14:37610 (RA;XA)

TROUT
Assessing the cost-effectiveness of alternative mitigation strategies: the simulation model, 14:35885 (RA;US)
Economic analyses of fish mitigation strategies, 14:35884 (RA;US)
Juvenile production, 14:35878 (RA;US)
Modeling downstream migration, 14:35879 (RA;US)
Modeling the estuary and early ocean life stanza, 14:35880 (RA;US)
Observations of lake trout (Salvelinus namaycush) spawning behaviour in low pH lakes near Sudbury, Ontario, 14:37391 (R;CA)
Reexamination of the use of otolith nuclear dimensions to identify juvenile anadromous and nonanadromous rainbow trout, Salmo Gairdneri, 14:37327 (J;US)
Smolt monitoring in the Columbia River Basin, 14:35883 (RA;US)

TRU WASTES
See ALPHA-BEARING WASTES

TRUCKS
Effects of road-surface properties on the fuel consumption of trucks and buses, 14:36405 (R;ZA)

TSCHEBYSCHEFF APPROXIMATION
See POLYNOMIALS

TSH
Israel EQAS for thyroid related hormones. Final report for the period June 1984 - February 1988, 14:37316 (R;XA)

TSP
See TOTAL SUSPENDED PARTICULATES

TUBES
A finite-element model for eddy-current nondestructive evaluation: Final report, 14:36086 (R;US)
The effect of transverse stress on the critical current of Nb_3Sn cable-in-conduit superconductors, 14:36931 (J;US)

TUBES (CONDUITS)
See PIPES

TUFF
Preliminary analyses in support of in situ thermomechanical investigations, 14:35809 (R;US)
Surface reactions of natural glasses, 14:35821 (BA;US)
Thermal-conductivity data for tuffs from the unsaturated zone at Yucca Mountain, Nevada: Yucca Mountain Project, 14:35807 (R;US)

TUMAN DEVICES
Fast current rise studied in the steady-state discharge of the Tuman-3 device, 14:37723 (RA;SU;In Russian)

TUMOR CELLS
Two families of human endogenous retroviral genomes, 14:37290 (RA;US)

TUMOR VIRUSES
See ONCOGENIC VIRUSES

TUMORS
See NEOPLASMS

TUNGSTATES
See also CESIUM TUNGSTATES
LITHIUM TUNGSTATES
RUBIDIUM TUNGSTATES
Connection between structure of alkali metal molybdates and tungstates and their spectral and energetic characteristics, 14:36763 (RA;SU;In Russian)
Enthalpies of melting and polymorphic transformations of alkali metal molybdates, tungstates, and chromates, 14:36761 (RA;SU;In Russian)
Thermodynamic properties of alkali metal chalcogenates, chromates, molybdates, and tungstates, 14:36764 (RA;SU;In Russian)

TUNGSTEN
Enhanced concentrations of Ni at grain boundary dislocations in Ni-treated W, 14:36511 (BA;FR)
Particle production results from HELIOS, 14:37595 (R;US)
Theoretical investigations of phonon anomalies in fcc La and W(001), 14:36603 (D;US)

TUNGSTEN ALLOYS
See also TUNGSTEN BASE ALLOYS
Corrosion of high-density sintered tungsten alloys. Part 1. Immersion testing, 14:36463 (R;AU)
Corrosion of high-density sintered tungsten alloys. Part 2. Accelerated corrosion testing, 14:36464 (R;AU)
TUNGSTEN BASE ALLOYS
Microstructural refinement of W-Ni-Fe heavy alloys by alloying additions, 14:36462 (R;US)
TUNGSTEN CARBIDES
Structural analysis and properties of grain boundaries in hexagonal carbides, 14:36628 (BA;FR)
TUNGSTEN COMPLEXES
Chemistry of bimetallic linked cyclopentadienyl complexes: Progress report, 1 December 1986–30 November 1989, 14:36738 (R;US)
TUNGSTEN COMPOUNDS
See also TUNGSTEN CARBIDES
TUNGSTEN OXIDES
Study of physicochemical properties of alkali metal salts of 12-tungstogallic acid, 14:36768 (RA;SU;In Russian)
TUNGSTEN OXIDES
Plasma spraying of WO/sub3/. Structure characterization of the coating, 14:36643 (R;CA)
TURBULENCE
Linear theory of uncompensated thermal blooming in turbulence, 14:37486 (R;US)
TURBULENT FLOW
Experimental study of the phenomena of turbulent flow in the narrow gaps between subchannels of rod bundles, 14:36033 (R;DE;In German)
Finite control volume modeling of laminar and turbulent flow of air in an enclosure, 14:37485 (R;US)
TEGENA: Detailed experimental investigations of temperature and velocity distributions in rod bundle geometries with turbulent sodium flow, 14:36032 (R;DE;In German)
TURKEY
Build-operate-transfer concept. A case history from Turkey, 14:35870 (RA;CA)
TVA
See TENNESSEE VALLEY AUTHORITY
TWO-PHASE FLOW
Gas-liquid flow in dividing Tee-junctions with a horizontal inlet and different branch orientations and diameters, 14:36981 (R;DE)
Interfacial area measurement methods, 14:36978 (R;US)
TYPE-II SUPERCONDUCTORS
Localized electrons in tetragonal $YBa_2Cu_{2.93}O_{6.38}$, 14:36644 (R;CA)
Microstructural investigation of $RBa_2Cu_3O_7$-δ (R=Y, Gd, Nd), 14:36645 (R;CA)
Solid-state interaction between nickel and $YBa_2Cu_3O_x$, 14:36646 (R;CA)
TYPE-III SUPERCONDUCTORS
See TYPE-II SUPERCONDUCTORS

U

UCLLL
See LAWRENCE LIVERMORE LABORATORY
ULTRASONIC TESTING
Benefits offered by an advanced US-technique in describing faults (ALOK), 14:36991 (RA;DE;In German)
ULTRAVIOLET RADIATION
See also EXTREME ULTRAVIOLET RADIATION
Resistance of bacterial spores to ultraviolet light, 14:37339 (R;US)
Studies of collisional and nonlinear radiative processes for development of coherent uv and xuv sources. Final report, 30 September 1985-29 September 1988, 14:37463 (R;US)
UNDERGROUND GASIFICATION
See IN-SITU GASIFICATION
UNDERGROUND MINING
See also LONGWALL MINING
ROOM AND PILLAR MINING
Technical note on the construction of stoppings or dams in the Sydney coalfield, 14:35574 (R;CA)
UNDULATORS
See WIGGLER MAGNETS
UNIFIED-FIELD THEORIES
See also GRAND UNIFIED THEORY
KOBAYASHI-MASKAWA MATRIX
Approximation of precompound effects in Hauser-Feshbach codes for calculating double differential (n, xn) cross sections, 14:37637 (J;US)
UNITED KINGDOM
Energy privatisation, 14:36271 (R;GB)
Lessons from gas privatisation, 14:36273 (RA;GB)
Why British coal should be privatised, 14:36272 (RA;GB)
UNITED STATES OF AMERICA
See USA
UNIVERSAL BLACKBODY RADIATION
See BLACKBODY RADIATION
UNIVERSE
Cosmic relics from the big bang, 14:37440 (R;US)
UNIVERSITIES
See EDUCATIONAL FACILITIES
UNSEALED SOURCES
Theory and practice of sanitary inspection of radiological units, 14:37650 (RA;SU;In Russian)
UPWELLING
Measurement of upwelling flow from Upper Bear Creek reservoir air diffusers, 14:35899 (R;US)
URANIUM
Fast Flux Test Facility metal fuel pin fabrication, 14:35759 (R;US)
Implementation of isotope correlation technique for safeguards, 14:35836 (R;US)
Separation potential of solvent extraction in the recovery of metals, 14:35762 (BA;US)
[Analytical chemistry in nuclear technology, Karlsruhe, Germany and visit to Seibersdorf, Austria, June 3–22, 1989]: Foreign trip report, 14:35766 (R;US)
URANIUM 234
$^{230}Th/^{234}U$ dating of the quaternary spring travertines in the Arava Rift Valley of Israel and paleoclimatic implications. Final report for the period 15 December 1986 - 15 December 1987, 14:37405 (R;XA)
URANIUM 235 TARGET
Analysis of dynamic characteristics of ^{235}U fission with resonance neutrons on the basis of data on fission fragment charge and mass fragmentation, 14:37634 (R;SU;In Russian)
Study on fragment charge and mass fragmentation in ^{235}U fission with resonance neutrons, 14:37604 (R;SU;In Russian)
URANIUM 236 TARGET
Estimations and theoretical forecasting of ^{236}U neutron data in the energy range of neutrons up to 20 MeV, 14:37625 (RA;SU;In Russian)
URANIUM 238 TARGET
Multiplicity of neutrons from violent heavy-ion collisions: ^{40}Ar + Th and U from 10 to 77 MeV/u, 14:37603 (R;DE)
URANIUM COMPLEXES
See also URANYL COMPLEXES
Metal extraction by amides of carboxylic acids, 14:36719 (RA;SU)
URANIUM DEPOSITS
Metallogenetic condition and mineralization characteristics of uranium deposit No.114, 14:35747 (R;CN;In Chinese)
URANIUM DIOXIDE
Compressive creep in nuclear oxides, 14:36614 (R;GB)
URANIUM FLUORIDES
See also URANIUM HEXAFLUORIDE
URANIUM TETRAFLUORIDE
Process and preparation facility for double uranium fluoride, 14:35761 (TG;US)
URANIUM HEXAFLUORIDE
A review of the Model 5A uranium hexafluoride cylinder, 14:35769 (R;US)
Monitoring of corrosion in ORGDP cylinder yards, 14:35777 (R;US)

Test emission of uranium hexafluoride in atmosphere. Results interpretation, 14:37198 (R;FR;In French)

URANIUM II
See URANIUM 234

URANIUM MINES
Air purification techniques for radon daughters in uranium mines, 14:35835 (RA;CA;In French)
Characterization of radioactive long-lived dust present in uranium mines and mills atmospheres, 14:35750 (RA;CA)
Randomization of grab sample strategies for estimating the exposure of uranium miners to radon daughters, 14:35748 (RA;CA)

URANIUM TETRAFLUORIDE
Investigation of hydrofluorination reactivity on denitrated uranium oxides, 14:35753 (R;CN;In Chinese)
Process and preparation facility for uranium tetrafluoride, 14:35760 (TG;US)

URANYL COMPLEXES
Acceptor extraction of uranyl salts with mixtures of organophosphoric acids with neutral additives, 14:36863 (RA;SU)
Complexation and extraction of halogenoacetates in ternary systems salt-water-extractant (Salt: uranyl compound.), 14:36862 (RA;SU)
Determination of thermodynamic characteristics of extraction equilibria in the systems containing ammonium salts and organic phosphorus compounds (Solvent extraction of nitrates of Ce, Pr, Eu, UO_2^{2+}, Th.), 14:36717 (RA;SU)
Equilibrium on metal extraction with substituted ammonium salts effect of non-ideality of the organic phase, 14:36861 (RA;SU)
Extraction properties of TBP - uranyl nitrate disolvate, 14:36718 (RA;SU)
Hydration and solvation energies and thermodynamic distribution coefficient of some extraction systems (Extraction systems: TBP-UO_2Cl_2($ThCl_4$)-HCL; AA-$InCl_3$-HCl, where AA-acetylacetone.), 14:36825 (RA;SU)
Mechanism of extraction of uranium (6) by mixtures of phosphororganic extractants, 14:36864 (RA;SU)
Thermodynamics of solvent extraction on $(C_8H_{17})_3N$-$C_6H_5CH_3$-UO_2Cl_2-HCl system, 14:36860 (RA;SU)

URANYL NITRATES
Investigation of hydrofluorination reactivity on denitrated uranium oxides, 14:35753 (R;CN;In Chinese)

URBAN AREAS
Energy Task Force status report for first quarter year ten, 14:36253 (R;US)
Estimating departure times from traffic counts using dynamic assignment, 14:36402 (R;US)

UREA
Applications of inclusion in separation science, 14:35915 (BA;US)

US AEC
See also BETTIS
FEED MATERIALS PRODUCTION CENTER
LASL
LAWRENCE LIVERMORE LABORATORY
ORNL
PADUCAH PLANT
SAVANNAH RIVER PLANT
Y-12 PLANT
Journal of Glenn T. Seaborg (Chairman, US Atomic Energy Commission, 1961 through 1971), July 1, 1961–December 31, 1961, 14:36249 (R;US)
Journal of Glenn T. Seaborg, Chairman of the US Atomic Energy Commission, 1961–1971: Volume 1, February 1, 1961–June 30, 1961, 14:36248 (R;US)

US ATOMIC ENERGY COMMISSION
See US AEC

US DOE
See also BETTIS
BONNEVILLE POWER ADMINISTRATION
FEED MATERIALS PRODUCTION CENTER
HANFORD RESERVATION
IDAHO NATIONAL ENGINEERING LABORATORY
LASL
LAWRENCE LIVERMORE LABORATORY
NEVADA TEST SITE
ORNL
PADUCAH PLANT
PITTSBURGH ENERGY TECHNOLOGY CENTER
PORTSMOUTH GASEOUS DIFFUSION PLANT
SAVANNAH RIVER PLANT
US DOE INSPECTOR GENERAL
Y-12 PLANT
Crisis management program for senior officials, 14:35830 (RA;US)
Impacts of DOE Order 5820.2A on Oak Ridge National Laboratory, 14:37227 (R;US)
Proceedings of the DOE quality conference: Managing for quality in a changing environment, 14:37787 (R;US)
Providing incentives for effective technology transfer, 14:36246 (J;US)
Transferring generic SARA/OSHA training to US Department of Energy facilities, 14:35825 (RA;US)

US DOE INSPECTOR GENERAL
Office of Inspector General semiannual report to the Congress, October 1, 1988–March 31, 1989, 14:36269 (R;US)

US EPA
National Air Audit System FY 1986-1987 national report. Final report, 14:37192 (R;US)

US NRC
NRC TLD [thermoluminescent dosimeter] Direct Radiation Monitoring Network: Progress report, January–March 1989, 14:37228 (R;US)
NUREG-1150 risk assessment methodology and results, 14:36177 (BA;DE)
Nuclear Regulatory Commission issuances, April 1989, 14:36049 (R;US)
Nuclear Regulatory Commission issuances, March 1989, 14:36048 (R;US)
Recommendations for resolution of public comments on USI [Unresolved Safety Issues] A-40, "Seismic Design Criteria", 14:36165 (R;US)

USA
See also FEDERAL REGION V
WASHINGTON DC
Documentation for the State Energy Data System 1960–1987 diskettes, 14:36341 (R;US)
Examination of noise-management approaches in the United States. Final report, 14:37399 (R;US)
Impact upon US security of a South African nuclear-weapons capability. Final technical report, 14:36458 (R;US)
Proceedings of the Chinese-American symposium on energy markets and the future of energy demand, 14:36258 (R;US)
Reasons for descisions-TransCanada Pipelines Ltd. Requests pertaining to the installation and to the approval of the method of devising rights and of the connected questions about rates, 14:35682 (R;CA;In French)

UTERINE CERVIX CARCINOMA
See CARCINOMAS

V

V CODES
Approaching distributed database applications using a programmable terminal emulator, 14:37819 (R;US)

VACUUM SYSTEMS
Recent results on cleaning and conditioning the ATF vacuum system, 14:37758 (R;US)

VALENCE ELECTRONS
See ELECTRONS

VAN DE GRAAFF ACCELERATORS
See also CRNL MP TANDEM ACCELERATOR
Beam transmission in MP equipment. New measurements. Main effects and application to VIVITRON, 14:37071 (R;FR;In French)

VANADATES
Electric conductivity of ternary phosphates and vanadates of alkali and rare earth metals (Alkali metals: K, Rb, Cs; rare earths: Pr, Ho, Gd.), 14:36746 (RA;SU;In Russian)

Lithium dodecavanadates with mixed oxidation degree of vanadium, 14:36774 (RA;SU;In Russian)
Mass spectrometric study of evaporation of rubidium and cesium vanadates, 14:36771 (RA;SU;In Russian)
Phase composition in the system $LiVO_3$-TiO_2-V_2O_5(V_2O_4), 14:36777 (RA;SU;In Russian)
Synthesis and structure of mixed by cation ternary vanadates $Me_2MeLn(VO_4)_2$, 14:36745 (RA;SU;In Russian)
Systems MVO_3-$Zn(VO_3)_2$ and MVO_3-$Mn(VO_3)_2$, where M=Li, Rb, Cs, 14:36770 (RA;SU;In Russian)
Vibrational spectra and structure of vanadates $M_2Zn(VO_3)_4$, where M-Rb, Cs, 14:36775 (RA;SU;In Russian)

VANADIUM
Optical-model calculations for experimental interpretation and evaluation: Practical considerations and fundamental implications, 14:37614 (RA;XA)

VANADIUM ALLOYS
An Auger sputter profiling study of nitrogen and oxygen ion implantation in two titanium alloys, 14:37688 (R;US)

VANADIUM COMPLEXES
Mechanism of extraction 4th period of periodic system metal ions with carboxylic acids in sulphate systems, 14:36828 (RA;SU)
Metal extraction by amides of carboxylic acids, 14:36719 (RA;SU)

VANADIUM MINERALS
See MINERALS

VANADIUM OXIDES
Phase composition in the system $LiVO_3$-TiO_2-V_2O_5(V_2O_4), 14:36777 (RA;SU;In Russian)
Phase diagram of the system $RbPO_3$-V_2O_5, 14:36747 (RA;SU;In Russian)
Phase ratios in the system Li_2O-K_2O-NiO-V_2O_5, 14:36801 (RA;SU;In Russian)

VECTOR PROCESSING
Computational fluid dynamics (CFD): element-by-element analysis for advanced computers. Final report, 1 April 1987-14 November 1988, 14:37479 (R;US)

VEGETABLES
Precooling vegetables using a block of ice produced by winter coolness., 14:36415 (RA;CA;In English and French)

VEGETATION
See PLANTS

VEHICLES
See also AUTOMOBILES
BUSES
TRUCKS
The US market for high-speed maglev vehicles, 14:36401 (R;US)

VENEZUELA
Feasibility of steam injection at 8200 feet, 14:35617 (RA;CA)
Regional characterization of geomechanical properties of unconsolidated sands of the heavy oil belt, Venezuela, 14:35734 (RA;CA)
Steam stimulation experience in Lake Maracaibo, 14:35616 (RA;CA)
The Jobo Steamflood Project: A preliminary evaluation of results, 14:35615 (RA;CA)

VENTILATION
Dynamic approach to the implementation of the optimization principles in uranium mines, 14:35749 (RA;CA)
Radon emanation at the Mullenbach research uranium mine and its effects on ventilation planning, 14:35752 (RA;CA)

VENTILATION DUCTS
See VENTILATION

VENTILATION SYSTEMS
Comparison of conventional mixing and displacement air conditioning and ventilating systems in US commercial buildings, 14:36386 (R;US)

VENTS
The influence of flue sharing on venting performance, 14:37025 (R;CA)

VERMONT YANKEE REACTOR
Use of statistics to monitor quality in training, 14:35987 (RA;US)

VESSELS
See CONTAINERS

VESSELS (PRESSURE)
See PRESSURE VESSELS

VESSELS (REACTOR)
See REACTOR VESSELS

VIDICONS
Spatial structure of transient plasmas revealed with a CCD camera, 14:37746 (BA;US)

VINYLBENZENE
See STYRENE

VIRUSES
See also ONCOGENIC VIRUSES
Evidence of host-mediated regulation of retroviral element expression at the posttranscriptional level, 14:37312 (RA;US)
Two families of human endogenous retroviral genomes, 14:37290 (RA;US)

VISCOSIMETERS
"Slip effects" in concentrated emulsions, 14:37132 (R;CA)

VISIBLE RADIATION
Photoadaptation and the package effect in Dunaliella tertiolecta (Chlorophyceae), 14:37253 (J;US)

VOCATIONAL TRAINING
See TRAINING

VOLATILE MATTER
Use of industrial-hygiene samplers for soil-gas measurement, 14:37221 (R;US)

VOLCANIC REGIONS
Modeling of subsurface geology in Medicine Lake, California, 14:35939 (R;US)

VOLCANISM
Computer simulations of explosive volcanic eruptions, 14:37410 (R;US)

VOLTAIC CELLS
See ELECTRIC BATTERIES

W

W. B. MC GUIRE-1 REACTOR
See MC GUIRE-1 REACTOR

W. B. MC GUIRE-2 REACTOR
See MC GUIRE-2 REACTOR

WALL EFFECTS
Review of synergisms in materials erosion due to multispecies impact, 14:37755 (R;CA)

WALLS
Thermal resistance measurement, 14:36396 (R;CA;In English and French)

WASHINGTON DC
History of the negotiations of the Washington Metropolitan Area Transit Authority, 14:36408 (R;US)

WASTE DISPOSAL
See also GROUND DISPOSAL
GROUND RELEASE
MARINE DISPOSAL
RADIOACTIVE WASTE DISPOSAL
SANITARY LANDFILLS
Cost impact of potential RCRA (Resource Conservation Recovery Act) changes on New York State Utility coal-waste disposal. Final report, 14:35563 (R;US)
Drum centrifuge modelling of long-term pollutant migration through a soil layer, 14:37222 (R;GB)
Hanford Site implementation of the National Environmental Policy Act: Activities tracking, 14:37276 (R;US)
Methodology for hazardous waste surveys, 14:35779 (R;US)
Trial-Burn Observation Guide. Final report, 14:36438 (R;US)

WASTE FORMS
Leaching of vitrified high-level-active-waste in a near reality simulated repository system. Final report, 14:35789 (R;DE;In German)
Solidification of low-level radioactive waste at the Savannah River Site, 14:35818 (R;US)

WASTE HEAT UTILIZATION
Waste heat recovery from a sulfuric acid plant, 14:36414 (R;DE;In German)

Waste heat recovery in remote communities. A shared opportunity, 14:35953 (R;CA)

WASTE MANAGEMENT
See also RADIOACTIVE WASTE MANAGEMENT
WASTE DISPOSAL
Sewage-sludge pretreatment and disposal. December 1981-February 1988 (Citations from the NTIS data base). Report for December 1981-February 1988, 14:36439 (R;US)
Sewage-sludge pretreatment and disposal. March 1988-April 1989 (Citations from the NTIS data base). Report for March 1988-April 1989, 14:36440 (R;US)
Summary report of capacity at commercial facilities. Volume 1. Summary report, 14:36435 (R;US)
Summary report of capacity at limited commercial and company-captive facilities. Volume 1. Draft report, 14:36436 (R;US)
Summary report of capacity at limited commercial and company-captive facilities. Volume 2. Draft report, 14:36437 (R;US)

WASTE PROCESSING PLANTS
Microbiological investigations on nitrification in waste water treatment plants with fixed sludge beds. Pt. 2. Pilot scale test. Final report, 14:35903 (R;DE;In German)
Sewage gas utilisation for cogeneration. Conference documentation, 14:36423 (R;DE;In German)
Using variable prices to improve productivity, 14:36306 (RA;US)

WASTE PRODUCT UTILIZATION
See also WASTE HEAT UTILIZATION
Feasibility study of utilization of coal-mine refuse; Estill County, Kentucky, 14:35562 (R;US)

WASTE SOLUTIONS
See LIQUID WASTES

WASTE WATER
Electrocoagulation of tar sand tailings pond waters, 14:35740 (RA;CA)
Evaluation criteria guide for water-pollution prevention, control, and abatement programs. Technical manual, 14:37281 (R;US)
Guide to land treatment of municipal waste water in Illinois, 14:36433 (R;US)
Hydrogeological and geochemical criteria for assessing sites of subsurface injection of EOR waste water in the Cold Lake area, Alberta, Canada, 14:35739 (RA;CA)
Inhibition of respiration in activated sludge by high carbon dioxide concentration: A laboratory study, 14:36428 (R;US)
Microbiological investigations on nitrification in waste water treatment plants with fixed sludge beds. Pt. 2. Pilot scale test. Final report, 14:35903 (R;DE;In German)

WASTEFORMS
See WASTE FORMS

WASTES
See also LIQUID WASTES
MUNICIPAL WASTES
RADIOACTIVE WASTES
SEWAGE
SOLID WASTES
High-sulfur spray dryer Shawnee test program: Characterization of 10-MW spray-dryer electrostatic precipitator by-product: Final report, 14:35963 (R;US)

WATER
See also GROUND WATER
WASTE WATER
Breakdown mechanisms of Al_2O_3, Cr_2O_3 and SiO_2 scales in $H_2/H_2O/H_2S$ environments: Final report, Volume 1, 14:35538 (R;US)
Effect of temperature and ionic impurities at very low concentrations on stress corrosion cracking of sensitized type 304 stainless steel, 14:36594 (BA;US)

WATER CHEMISTRY
Event studies and the interpretation of water quality in forested basin, 14:37245 (RA;NO)
Experience from integated simulations of runoff, water quality and residence time. International symposium on acidification and water pathways, 14:37264 (RA;NO)
Hydrologic and chemical characteristics of darkwater, clearwater and acidic lakes in the United States, 14:37267 (RA;NO)
Relation between water flow paths in the soil and runoff chemistry at Risdalsheia, a small headwater catchment in southern Norway, 14:37265 (RA;NO)

WATER COOLANT
See WATER

WATER COOLED GRAPHITE MODERATED REACTORS
See LWGR TYPE REACTORS

WATER COOLED REACTORS
See also ATR REACTOR
BWR TYPE REACTORS
HCLWR TYPE REACTORS
LWGR TYPE REACTORS
PWR TYPE REACTORS
TRIGA TYPE REACTORS
A sensitivity of aerosol agglomeration and deposition using the MAEROS model, 14:36188 (BA;US)
Characterization and chemistry of fission products released from LWR fuel under accident conditions, 14:36184 (BA;US)
Effects on consequences of the high steam content in LWR accident releases, 14:36195 (BA;US)
LWR aerosol containment experiments (LACE) program and initial test results, 14:36187 (BA;US)

WATER HEATERS
Residential domestic water heating advisory computer program. Vol. 1, technical report, 14:36373 (R;CA)
Residential domestic water heating advisory computer program. Vol. 2, computer user's guide. Vol. 3, programmer's guide, 14:36372 (R;CA)
Village energy retrofit of electric domestic water heating in a B.C. Hydro diesel generating area, 14:36371 (R;CA)

WATER HEATING
Potential of electric heat pumps for heating water in South Africa, 14:36391 (R;ZA)

WATER MODERATOR
See WATER

WATER POLLUTION
Corrosion aggressiveness og groundwaters on the underground route in Warsaw, 14:37269 (RA;NO)
Use of industrial-hygiene samplers for soil-gas measurement, 14:37221 (R;US)

WATER POLLUTION ABATEMENT
Evaluation criteria guide for water-pollution prevention, control, and abatement programs. Technical manual, 14:37281 (R;US)

WATER POLLUTION CONTROL
Evaluation criteria guide for water-pollution prevention, control, and abatement programs. Technical manual, 14:37281 (R;US)

WATER POLLUTION MONITORS
Review of environmental monitoring equipment for air water and soil systems. Vol. 2-Environmental monitoring equipment database, 14:35966 (R;CA)
Review of environmental monitoring equipment for air, water and soil systems. Vol 2(ii)-Equipment data sheets. Record #247-528, 14:35965 (R;CA)
Review of environmental monitoring equipment for air, water and soil systems. Vol. 2(iii)-Equipment data sheets. Record #529-586, user and utility information records, 14:35964 (R;CA)
Review of environmental monitoring equipment for air, water and soil systems. Vol. 1 - Instrument review, 14:35967 (R;CA)

WATER QUALITY
Managing data from a large-scale groundwater monitoring program, 14:37255 (R;US)
The need for control agencies to update today's conceptual basis for groundwater quality requirements and subsurface evaluation guidelines, 14:37223 (R;US)

WATER RESOURCES
Effect of acidification on structures in soil and water, 14:37268 (RA;NO)
Fiscal year 1987 program report (Massachusetts Water Resources Research Center). Annual report, 14:37280 (R;US)
Relation between water flow paths in the soil and runoff chemistry at Risdalsheia, a small headwater catchment in southern Norway, 14:37265 (RA;NO)

WATER SOURCE HEAT PUMPS
Uppsala heat pump. Evaluation of a district heating heatpump abstracting heat from sewage effluents, 14:36421 (R;SE;In Swedish)
WATER TREATMENT
Loch Fleet Project, 14:37244 (RA;NO)
WATER UTILITIES
Computer-assisted control for municipal water systems: Phase 1, Design for energy cost savings, 14:36427 (R;US)
Computer-assisted control for municipal water systems: Phase II, Implementation of a computer-assisted energy management program, 14:36254 (R;US)
WATERBORNE PARTICLES
See PARTICULATES
WATERFORD-3 REACTOR
Radiation monitoring training system - an aid to performance-based training, 14:36141 (RA;US)
WATERSHEDS
Oxygen isotopic composition of sulphates in the uplandforest of the plastic lake watershed, 14:37237 (RA;NO)
Processes affectin the chemistry of waters passing through a high elevator Sierra Nevada watershed, 14:37240 (RA;NO)
WATERWALL FURNACES
See WATERWALL INCINERATORS
WATERWALL INCINERATORS
National incinerator testing and evaluation program. Environmental characterization of mass burning incinerator technology at Quebec City. Summary report, 14:37168 (R;CA)
National incinerator testing and evaluation program. Environmental characterization of mass burning incinerator technology at Quebec City. Summary report, 14:37169 (R;CA;In French)
National incinerator testing and evaluation program. Environmental characterization of mass burning incinerator technology at Quebec City. Summary report, 14:37168 (R;CA)
WATTS BAR-1 REACTOR
Annual radiological environmental monitoring report, Watts Bar Nuclear Plant, 14:37229 (R;US)
WATTS BAR-2 REACTOR
Annual radiological environmental monitoring report, Watts Bar Nuclear Plant, 14:37229 (R;US)
WAVEGUIDES
Correction of field distribution in an H-wave weakly irregular accelerating structure, 14:37054 (R;SU;In Russian)
Quasistatic model of H-wave accelerating structures, 14:37053 (R;SU;In Russian)
WAZ 16
See NICKEL BASE ALLOYS
WEAPONS
See also NUCLEAR WEAPONS
Chemistry and Materials Science research report: Weapons-Supporting Research and Departmental Institutional Research and Development: First half FY1989, 14:37158 (R;US)
Ultrasonic systems and system development at SNL Albuquerque, 14:36997 (R;US)
WEAR RESISTANCE
Ion-assisted deposition of silver films on ceramics for friction and wear control, 14:36478 (R;US)
WECS
See WIND TURBINES
WELDED JOINTS
Evaluation of weldment creep and fatigue strength-reduction factors for elevated-temperature design, 14:36083 (R;US)
Welding '88. Nondestructive testing of welded joints, 14:36990 (R;CS;In Slovak, Czech)
WELDING
See also ARC WELDING
ELECTRON BEAM WELDING
LASER WELDING
Health-hazard evaluation determination report No. 73-185-256, Electromotive-Division, GMC (Plant 2), Chicago, Illinois, 14:37186 (R;US)
Health-hazard evaluation determination report No. 75-109, 110, 112, 114-274, Fairbanks Weighing Division, Colt Industries, St. Johnsbury, Vermont, 14:37182 (R;US)
Welding in nuclear technology. Scientific-technical collection, 14:36559 (R;SU;In Russian)
WELDS
See WELDED JOINTS
WELL CASINGS
Abrasive slotting of casing for use in heavy oil well completions and workovers, 14:35619 (RA;CA)
Corrosion problems and experience at AOSTRA in-situ thermal recovery pilots, 14:36468 (RA;CA)
Feasibility of steam injection at 8200 feet, 14:35617 (RA;CA)
Investigation of a premium casing connection for Canadian thermal recovery wells, 14:35627 (RA;CA)
Mobil Oil Canada's use of insulated tubulars in thermal projects, 14:35724 (RA;CA)
Production of ERW L80 for enhanced recovery wells, 14:36471 (RA;CA)
Steam stimulation experience in Lake Maracaibo, 14:35616 (RA;CA)
The development of Mod N-80HO casing for cyclical steam stimulation, 14:36470 (RA;CA)
WELL COMPLETION
Thermal completions for radial production systems, 14:35625 (RA;CA)
Thermal well completions seminar, 14:35722 (R;CA)
WELL STIMULATION
Challenges and innovations 1989. 6th Annual heavy oil and oil sands technical symposium, 14:35691 (R;CA)
WELLS
See also GEOTHERMAL WELLS
INJECTION WELLS
NATURAL GAS WELLS
OIL WELLS
Experimental data on weakening gamma-radiation by boring well, 14:37648 (RA;SU;In Russian)
WEST GERMANY
See FEDERAL REPUBLIC OF GERMANY
WETLANDS
See also SWAMPS
Regeneration patterns in a southeastern floodplain forest, 14:37213 (J;US)
Response of wetland herb communities to gradients of disturbance and substrate, 14:37214 (J;US)
WIGGLER MAGNETS
Proceedings of the small period wiggler designs workshop: Summary, 14:36962 (R;US)
WIND
A wind shielded fire test facility, 14:36887 (R;US)
WIND ENERGY CONVERSION SYSTEMS
See WIND TURBINES
WIND GENERATORS
See WIND TURBINES
WIND POWER
Cogeneration in Europe, 14:36250 (RA;US)
WIND TURBINES
See also HORIZONTAL AXIS TURBINES
Damage predictions for wind turbine components using the LIFE2 computer code, 14:36881 (R;US)
WINDOWS
WINDOW 3.1: A PC program for analyzing window thermal performance: Program description and tutorial, 14:36385 (R;US)
WOLFRAM
See TUNGSTEN
WOOD
A field evaluation of four wood pole groundline preservative formulations using western Canadian wood species, 14:36674 (R;CA)
Glucose yields from the solvolysis of wood and pure cellulose by anhydrous Hydrogen Fluoride vapor, 14:35869 (BA;US)
Steam pretreatment of wood in relation to enzymatic hydrolysis. Final report, 14:35904 (R;CA)
Thermal properties of wood and wood panel products for use in buildings, 14:36378 (R;US)
WOOD ALCOHOL
See METHANOL

WOOD BURNING APPLIANCES
Whitehorse efficient woodheat demonstration, 14:35865 (R;CA)
WOOD OILS
Study of the conversion of lignocellulosic (aspen) materials to liquid fuels and chemicals, 14:35862 (R;CA)
Wood sugars to energy-intensive organic chemicals: Phase 1. Final report, 14:35858 (R;US)
WOOD WASTES
Woodchip production and transporation in Newfundland. Overview, 14:35866 (RA;CA)
WOOL
Further studies of respiratory health of wool textile workers. Final report, October 1986-July 1988, 14:37191 (R;GB)
WORKERS
See PERSONNEL
WORKING FLUIDS
See also REFRIGERANTS
Study of data distributions and functions for the development of thermodynamic equations of state. Annual report, June 1987-May 1988, 14:35686 (R;US)
WWER TYPE REACTORS
HOST optimization program complex for management of the WWER internal fuel cycle, 14:36009 (RA;SU;In Russian)
Method for calculating hydrogen propagation accidents in NPP compartments under accidents, 14:36154 (RA;SU;In Russian)
Stratification of coolant non-isothermal turbulent flows in power plant components, 14:36008 (RA;SU;In Russian)

X

X-2830 RESONANCES
See MESONS
X-RASERS
See X-RAY LASERS
X-RAY DIFFRACTION
Electrochemically adsorbed Pb on Ag (111) studied with grazing- incidence x-ray scattering, 14:36854 (R;US)
X-RAY LASERS
Coherent VUV laser at 130nm, 14:36973 (BA;US)
Study of atomic physics and population inversions with plasma focus, 14:37473 (R;US)
XENON
Multiphoton ionization of $(Xe)_n$ and $(NO)_n$ clusters using a picosecond laser, 14:37464 (R;US)
Multiple ionization of xenon by proton impact, 14:37462 (R;US)
Two dimensional phase equilibria at surfaces, 14:37671 (BA;FR)
XENON COMPOUNDS
Protolytic properties of perxenic acid, 14:36853 (J;US)
XUV
See EXTREME ULTRAVIOLET RADIATION
XYLENES
Containment of organic leachates from leaking underground storage tanks using tailored soils as liners, 14:37216 (R;US)

Y

Y-12 PLANT
Nonfilm radiography at the Oak Ridge Y-12 Plant, 14:37121 (R;US)
YANG-MILLS THEORY
On the construction of certain instanton bundles over flat tori, 14:37546 (R;DE)
Wormhole instanton solution in the Einstein-Yang-Mills system, 14:37445 (R;JP)
YANKEE VERMONT REACTOR
See VERMONT YANKEE REACTOR
YEASTS
Cellular stress induced by UV-radiation and hyperthermia - a common mechanism, 14:37353 (RA;AU)
Genetic control of recombination between repeated sequences, 14:37293 (RA;US)
Regulation of yeast Ty element transposition, 14:37310 (RA;US)
YIELDS
Refinery yield model spreadsheet system (RYMSS) documentation, 14:35640 (R;US)
YTTERBIUM 152
On the feeding and spectroscopy of superdeformed states, 14:37635 (R;SE)
YTTERBIUM 175
Intensive two-quantum cascades and fragmentation of quasiparticle states in some deformed nuclei, 14:37633 (R;SU;In Russian)
YTTRIUM
Low-temperature isotopic exchange in molecular hydrogen on films of transition and rare earth metals and their alloys with copper, 14:36813 (RA;SU;In Russian)
YTTRIUM ALLOYS
Low-temperature isotopic exchange in molecular hydrogen on films of transition and rare earth metals and their alloys with copper, 14:36813 (RA;SU;In Russian)
YTTRIUM ALUMINIUM GARNETS
See ALUMINIUM OXIDES
YTTRIUM COMPOUNDS
YTTRIUM COMPLEXES
Role of the liquid-liquid partition coefficient of the extractable chelate in the extraction efficiency of metals with β-diketones (Metals: rare earths, scandium, yttrium.), 14:36819 (RA;SU)
Trials on the molecule design of organic extractants, 14:36841 (RA;SU)
YTTRIUM COMPOUNDS
See also YTTRIUM FLUORIDES
YTTRIUM NITRATES
YTTRIUM OXIDES
YTTRIUM PHOSPHATES
^{17}O NMR study of $YBa_2Cu_3O_{7-\delta}$, 14:36641 (R;US)
Anomalous temperature dependence of Cu NMR line width and magnetization in $YBa_2Cu_3O_{7-\delta}$, 14:36642 (R;US)
Consolidation of powders of the oxide superconductor YBa_2Cu_3Ox by high energy-high rate processing, 14:36611 (R;US)
Nuclear relaxation rates at copper and oxygen sites in $YBa_2Cu_3O_7$, 14:36640 (R;US)
Phase equilibria in the systems Li_2MoO_4-$BaMoO_4$-$Ln_2(MoO_4)_3$, Ln=La-Lu, Y. Luminescence of $Li_3Ba_2Ln_3(MoO_4)_8$-Nd^{3+}, 14:36760 (RA;SU;In Russian)
Study of the system LiC_2H_5COO-$Y(C_2H_5COO)_3$-H_2O at 25 deg C, 14:36784 (RA;SU;In Russian)
Thermal conductivity anisotropy in single crystal $YBa_2Cu_3O_{7-x}$, 14:36616 (R;US)
YTTRIUM FLUORIDES
Interaction of ammonium fluoroyttrates with lithium salts, 14:36783 (RA;SU;In Russian)
YTTRIUM NITRATES
Formation conditions and some properties of double nitrates of rare alkali metals and rare earths, 14:36781 (RA;SU;In Russian)
YTTRIUM OXIDES
A film transmission line resonator to measure the microwave surface resistance of $YBa_2Cu_3O_{7-x}$, 14:36901 (J;US)
A simple method for preparing superconducting high Tc thin films, 14:36956 (J;US)
Anisotropies in the magnetic penetration depth and critical current density of $R_1Ba_2Cu_3O_{7-x}$ (R = Y or Ho), measured on magnetically-aligned powder composites, 14:36952 (J;US)
Characterization of YBaCuO and ErBaCuO thin films deposited on silicon and gallium arsenide substrates, 14:36899 (J;US)
Effect of Y_2O_3 additions on the plasticity of sintered Cr_2O_3, 14:36607 (J;US)
Flux noise and flux creep in YBCO thin films, 14:36897 (J;US)
Grain size control in powder processed $Y_1Ba_2Cu_3O_x$, 14:36947 (J;US)
High resolution electron microscopy of interfaces in functional materials, 14:36623 (BA;FR)
In situ growth of superconducting YBaCuO using reactive electron-beam coevaporation, 14:36955 (J;US)

Low contact-resistivity junctions to ceramic superconductors, 14:36945 (J;US)
Low frequency resistance fluctuations in films of high temperature superconductors, 14:36900 (J;US)
Phase relations in quaternary copper oxide electrodes, 14:36652 (BA;US)
RF electromagnetic investigation of an $YBa_2Cu_3O_7$ thin film by proximity coupling, 14:36902 (J;US)
TEM study of ZrO_2/Al interface, 14:36629 (BA;FR)
X-ray absorption spectroscopy investigations of high Tc superconductors, 14:36649 (BA;US)

YTTRIUM PHOSPHATES
Ternary phosphates $Ca_9LiR_23/(PO_4)_7$ (R=rare earths, Y, Bi), 14:36756 (RA;SU;In Russian)

YUCCA MOUNTAIN
Preliminary analyses in support of in situ thermomechanical investigations, 14:35809 (R;US)

YUKON TERRITORY
Proceedings of the technology transfer workshop [for] northern water quality monitoring, 14:37256 (R;CA)
Whitehorse efficient woodheat demonstration, 14:35865 (R;CA)

Z

Z NEUTRAL BOSONS
Z^0 physics at the SLC, 14:37513 (R;US)

Z PINCH DEVICES (LINEAR)
See LINEAR Z PINCH DEVICES

ZEA MAYS
See MAIZE

ZEOLITES
Conversion of methanol over zeolite ZSM-5, 14:35859 (R;ZA)
Energy storage by adsorption of water on zeolite for building heating, 14:36211 (RA;CA;In English and French)
Preparation of zeolites for TEM using microtomy, 14:36688 (BA;US)

ZINC
Dependence of diffusion-induced grain boundary migration on grain boundary structure, 14:36527 (BA;FR)
Diffusion induced grain boundary migration in Ni(Zn) polycrystals, 14:36523 (BA;FR)
Grain boundary structure in HCP metals, 14:36490 (BA;FR)
Trace metal removal by iron coprecipitation: Field evaluation: Final report, 14:35960 (R;US)

ZINC 68 TARGET
Transition between phenomena governed by the mean field and those governed by nucleon-nucleon collisions in the reaction $^{40}Ar + {}^{68}Zn$, 14:37580 (R;FR;In French)

ZINC ALLOYS
See also BRASS
Hydrogen embrittlement in grain boundaries studied by fatigue crack propagation in Al-Zn-Mg bicrystals, 14:36987 (BA;FR)

ZINC COMPOUNDS
See also ZINC SULFIDES
ZINC TELLURIDES
Systems MVO_3-$Zn(VO_3)_2$ and MVO_3-$Mn(VO_3)_2$, where M=Li, Rb, Cs, 14:36770 (RA;SU;In Russian)

ZINC SULFIDES
Clasterization of isoelectronic tellurium addition in $ZnS_{1-x}Te_x$ solid solution, 14:37681 (RA;SU;In Russian)

ZINC TELLURIDES
Clasterization of isoelectronic tellurium addition in $ZnS_{1-x}Te_x$ solid solution, 14:37681 (RA;SU;In Russian)
Polycrystalline cadmium telluride n-i-p solar cell: Annual subcontract report, 1 June 1987–31 August 1988, 14:35912 (R;US)

ZIRCONIUM
Effect of construction of current and gas supply on protective atmosphere composition in welded installation, 14:36565 (RA;SU;In Russian)
Fast Flux Test Facility metal fuel pin fabrication, 14:35759 (R;US)
Health-hazard evaluation determination report No. 74-78-297, Amax Speciality Metals, Parkersburg, West Virginia, 14:37185 (R;US)

ZIRCONIUM 90
On the two gas approach for exciton model master equation, 14:37611 (RA;XA)

ZIRCONIUM 90 TARGET
Effects of realistic partial state densities on preequilibrium decay, 14:37616 (RA;XA)

ZIRCONIUM 91 TARGET
Effects of realistic partial state densities on preequilibrium decay, 14:37616 (RA;XA)

ZIRCONIUM 92 TARGET
Effects of realistic partial state densities on preequilibrium decay, 14:37616 (RA;XA)

ZIRCONIUM 94 TARGET
Effects of realistic partial state densities on preequilibrium decay, 14:37616 (RA;XA)

ZIRCONIUM ALLOYS
See also ZIRCONIUM BASE ALLOYS
Evolution of the chemistry of passive films of sputter-deposited, supersaturated Al alloys. Annual report, 1 July 1987-30 November 1988, 14:36461 (R;US)
Interfaces in composites reinforced with rapidly solidified metallic ribbons, 14:36495 (BA;FR)

ZIRCONIUM BASE ALLOYS
Increasing of effeciency and quality of electron beam welding of zirconium alloys by using and additional vacuum chamber, 14:36561 (RA;SU;In Russian)

ZIRCONIUM COMPLEXES
Application of eda interactions for explaining and forecasting the extractive ability of elementoorganic reagents, 14:36858 (RA;SU)
Electron structure and electrostatic potential of some neutral organophosphorus extractants and their complexes, 14:36818 (RA;SU)
Mechanism of nitric acid and strontium extraction with zirconium di-2-ethylhexyl phosphate complexes-studying by the ^{14}N and ^{31}P NMR methods, 14:36837 (RA;SU)
State of water in extracts and its interaction with microwave field, 14:36824 (RA;SU)

ZIRCONIUM OXIDES
Effect of thermal aging on mechanical and electrical properties of the MgO-partially stabilized zirconia bodies, 14:36526 (BA;FR)
TEM study of ZrO_2/Al interface, 14:36629 (BA;FR)
Transformation toughening of ceramics. Final report, 1 September 1985-31 August 1988, 14:36612 (R;US)

Contract Number Index

Numbers assigned to DOE contracts announced in documents in this publication are listed. Contract numbers are sorted alphanumerically and list the primary corporate author of the document cited, the citation number, and the report number or other document identification.

Contract No.	Abstract No.	Report No.
AA03-76SF00034	**Stanford Linear Accelerator Center, Menlo Park, CA (USA)**	
	14:37096	SLAC-PUB-4961
AC01-84FE60457	**SFA Pacific, Inc., Mountain View, CA (USA)**	
	14:35523	DOE/FE/60457-H4
AC01-84PE70411	**Pechan (E.H.) and Associates, Inc., Springfield, VA (USA)**	
	14:37803	DOE/PE/70411-T2
AC01-87ER40355	**National Academy of Sciences - National Academy of Engineering, Washington, DC (USA). Super Collider Site Evaluation Committee**	
	14:37033	DOE/ER/40355-T1
AC02-76CH00016	**Brookhaven National Lab., Upton, NY (USA)**	
	14:36128	BNL-41450
	14:36129	BNL-NUREG-42727
	14:36659	BNL-42655
	14:36735	BNL-42831
	14:37030	BNL-42333
	14:37068	BNL-52169
	14:37163	BNL-42768
	14:37425	BNL-42627
	14:37497	BNL-42049
	14:37596	BNL-42803
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering	
	14:35794	NUREG/CR-5363
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications	
	14:36159	NUREG/CR-3469-Vol.4
	14:36160	NUREG/CR-4409-Vol.3
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution	
	14:36165	NUREG/CR-5347
AC02-76CH03000	**Notre Dame Univ., IN (USA). Dept. of Physics**	
	14:37109	DOE/ER/40372-T1
	Fermi National Accelerator Lab., Batavia, IL (USA)	
	14:37051	FNAL/C-89/115
	14:37074	FNAL/C-89/126
	14:37438	FNAL/C-89/112-A
	14:37517	FNAL/C-89/104-A
	14:37548	FNAL/C-89/116-T
	14:37549	FNAL/C-89/125-T
AC02-76CH03073	**Princeton Univ., NJ (USA). Plasma Physics Lab.**	
	14:37458	PPPL-2628
	14:37738	PPPL-2623
	14:37739	PPPL-2630
	14:37740	PPPL-2631
	14:37741	PPPL-2634
	14:37772	PPPL-2625
AC02-76ER00881	**Wisconsin Univ., Madison, WI (USA)**	
	14:37491	DOE/ER/00881-T1
	14:37126	Published article
	14:37124	Published article
AC02-76ER03130	**Brown Univ., Providence, RI (USA)**	
	14:37028	DOE/ER/03130-48C
	14:37104	DOE/ER/03130-43C
	14:37105	DOE/ER/03130-44C
	14:37106	DOE/ER/03130-45C
	14:37492	DOE/ER/03130-3
	14:37499	DOE/ER/03130-46C
	Brown Univ., Providence, RI (USA). Dept. of Physics	
	14:37102	DOE/ER/03130-5
	14:37103	DOE/ER/03130-41C
	14:37493	DOE/ER/03130-425
	14:37500	DOE/ER/03130-50C
	14:37501	DOE/ER/03130-267
AC02-76ER03230	**Brandeis Univ., Waltham, MA (USA). Dept. of Physics**	
	14:37494	DOE/ER/03230-T8
	14:37638	Published article
AC02-80ET15601	**Mississippi State Univ., Mississippi State, MS (USA). MHD Energy Center**	
	14:36345	DOE/ET/15601-30
AC02-80RA50153	**General Electric Co., Lenox, MA (USA). High Voltage Transmission Research Center**	
	14:35969	DOE/RA/50153-3
AC02-83CH10093	**Solar Energy Research Inst., Golden, CO (USA)**	
	14:35908	SERI/CP-213-3495
	14:35909	SERI/SP-220-3366
	14:35910	SERI/SP-320-3396
	14:35925	DOE/CH/10093-46
	14:35930	SERI/SP-220-3237
	14:35952	SERI/TP-217-3505
	14:35911	SERI/STR-211-3511
	14:35912	SERI/STR-211-3519
	14:35913	SERI/STR-211-3523
	14:35914	SERI/STR-211-3528
AC02-86ER40253	**Colorado Univ., Boulder, CO (USA)**	
	14:37495	DOE/ER/40253-148
	14:37539	Published article
AC02-87ER40372	**Notre Dame Univ., IN (USA). Dept. of Physics**	
	14:37109	DOE/ER/40372-T1
AC03-76SF00098	**Lawrence Berkeley Lab., CA (USA)**	
	14:36574	LBL-25831
	Los Alamos National Lab., NM (USA)	
	14:37089	LA-UR-89-2071
	Lawrence Berkeley Lab., CA (USA)	
	14:36248	LBL-PUB-625-Vol.1
	14:36249	LBL-PUB-625-Vol.2
	14:36258	LBL-26260
	14:36362	LBL-27082
	14:36384	LBL-25363
	14:36385	LBL-25686
	14:36386	LBL-26816
	14:36575	LBL-26942
	14:36576	LBL-27271

Contract No.	Abstract No.	Report No.
	14:36725	LBL–24944
	14:36726	LBL–27166
	14:36845	LBL–25559
	14:36854	LBL–27046
	14:36964	LBL–27034
	14:36965	LBL–27035
	14:37064	LBL–27189
	14:37440	LBL–26210
	14:37441	LBL–27233
	14:37527	LBL–27134
	14:37599	LBL–27116
	14:37709	LBL–25609
	14:36338	LBL–27130
	14:37538	Published article
	14:37540	Published article
AC03-76SF00515	**Stanford Linear Accelerator Center, Menlo Park, CA (USA)**	
	14:37065	SLAC-PUB–4882
	14:37066	SLAC-PUB–4928
	14:37094	SLAC-PUB–4893
	14:37095	SLAC-PUB–4926
	14:37119	SLAC-PUB–4942
	14:37513	SLAC-PUB–4816
	14:37514	SLAC-PUB–4985
	14:37531	SLAC-PUB–4881
	14:37532	SLAC-PUB–4955
	14:37533	SLAC-PUB–4973
	14:37534	SLAC-PUB–4983
	14:37535	SLAC-PUB–4987
	14:37126	Published article
	14:37558	Published article
	14:37559	Published article
	14:37711	Published article
	14:37538	Published article
AC03-83ER40103	**Stanford Linear Accelerator Center, Menlo Park, CA (USA)**	
	14:37096	SLAC-PUB–4961
AC03-88ER80652	**Therma-Wave, Inc., Fremont, CA (USA)**	
	14:36616	CONF-890754–1
AC03-88SF17714	**Ackco, Inc., Boulder, CO (USA)**	
	14:36379	DOE/SF/17714–T1
AC03-89ER51114	**General Atomics Co., San Diego, CA (USA)**	
	14:37761	GA-A–19684
AC04-76DP00789	**Sandia National Labs., Albuquerque, NM (USA)**	
	14:35807	SAND–88-0624
	14:35808	SAND–88-2294
	14:35809	SAND–88-2785
	14:35810	SAND–88-3352
	14:35811	SAND–89-0462
	14:35845	SAND–89-1110C
	14:35846	SAND–89-1111C
	14:35847	SAND–89-1601C
	14:35848	SAND–89-1603C
	14:35849	SAND–89-1604C
	14:35850	SAND–89-1605C
	14:35851	SAND–89-1645C
	14:35943	SAND–89-0079
	14:35975	SAND–88-2932
	14:36397	SAND–89-1595C
	14:36409	SAND–88-3334C
	14:36582	SAND–87-1249
	14:36583	SAND–88-0973C
	14:36584	SAND–89-0506C
	14:36585	SAND–89-0521
	14:36586	SAND–89-0815C
	14:36647	SAND–88-2865C
	14:36881	SAND–88-3057C
	14:36882	SAND–88-3169C
	14:36883	SAND–88-3271
	14:36886	SAND–89-1113C
	14:36887	SAND–89-1212C
	14:36888	SAND–89-1312C
	14:36889	SAND–89-1402
	14:36890	SAND–89-1587C
	14:36891	SAND–89-1594C
	14:36892	SAND–89-1616C
	14:36995	SAND–89-0343C
	14:36996	SAND–89-0727
	14:36997	SAND–89-1406C
	14:37015	SAND–89-0037
	14:37016	SAND–89-0068C
	14:37017	SAND–89-0292C
	14:37018	SAND–89-1569C
	14:37023	SAND–89-1385C
	14:37045	SAND–89-0863C
	14:37092	SAND–88-3360C
	14:37093	SAND–89-0523
	14:37130	SAND–89-0334C
	14:37144	SAND–88-3153
	14:37145	SAND–89-0133C
	14:37146	SAND–89-1192C
	14:37149	SAND–89-0677C
	14:37157	SAND–89-0666
	14:37300	SAND–89-1145C
	14:37402	SAND–89-0889
	14:37412	SAND–89-0155
	14:37413	SAND–89-1366C
	14:37476	SAND–89-1546C
	14:37482	SAND–88-3037C
	14:37483	SAND–89-0025C
	14:37484	SAND–89-0046C
	14:37485	SAND–89-0780C
	14:37689	SAND–89-0542C
	14:37690	SAND–89-1346C
	14:37698	SAND–89-1496C
	14:37742	SAND–88-3311C
	14:37743	SAND–89-0443C
	14:37773	SAND–88-3437C
	14:37774	SAND–89-0007C
	14:37775	SAND–89-0275C
	14:37776	SAND–89-0354C
	14:37777	SAND–89-0894C
	14:37778	SAND–89-1390C
	14:37779	SAND–89-1495C
	14:37780	SAND–89-1522C
	14:37789	SAND–89-1029C
	14:37790	SAND–89-1108C
	14:37791	SAND–89-1109C
	14:37792	SAND–89-1609C
	14:37809	SAND–88-3041C
	14:37810	SAND–88-3089C
	14:37811	SAND–89-0008
	14:37812	SAND–89-1575C
	14:37822	SAND–88-3439
	14:35926	SAND–89-7027
	Los Alamos National Lab., NM (USA)	
	14:36844	LA-UR–89-1883
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering	
	14:35792	NUREG/CR–4759
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications	
	14:37380	NUREG/CR–4214-Rev.1-Pt.2
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research	
	14:36161	NUREG/CR–4961
	14:36163	NUREG/CR–5252
	14:36606	Published article

Contract No.	Abstract No.	Report No.
AC04-76DP03533	**Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant**	
	14:35758	RFP–4207
	14:35843	RFP–4296
	14:35844	RFP–4307
	14:36581	RFP-Trans–500
	14:36994	RFP–4297
AC04-76DR00789	**Sandia National Labs., Albuquerque, NM (USA)**	
	14:36884	SAND–88-8934
	Sandia National Labs., Livermore, CA (USA)	
	14:35592	SAND–89-8241
	14:36885	SAND–88-8935
AC04-88DP43495	**EG and G Mound Applied Technologies, Miamisburg, OH (USA)**	
	14:36678	MLM–3592(OP)
	14:36727	MLM–3596
	14:36879	MLM–3597
	14:37140	MLM–3593(OP)
	14:37152	MLM–3590
	14:37688	MLM–3951(OP)
AC05-76OR00001	**Martin Marietta Energy Systems, Inc., Portsmouth, OH (USA). Quality and Technical Services Div.**	
	14:35769	POEF-T–3504
	Martin Marietta Energy Systems, Inc., Piketon, OH (USA)	
	14:35842	POEF–2007
AC05-76OR00033	**Oak Ridge National Lab., TN (USA)**	
	14:35825	CONF-890470–
	14:35826	CONF-890470–
	14:35830	CONF-890470–
AC05-84ER40150	**Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility**	
	14:37031	DOE/ER/40150–79
	14:37032	DOE/ER/40150–80
	14:37107	DOE/ER/40150–82
	14:37502	DOE/ER/40150–74
	14:37566	DOE/ER/40150–73
	14:37567	DOE/ER/40150–75
	14:37568	DOE/ER/40150–78
	14:37569	DOE/ER/40150–81
AC05-84OR21400	**Oak Ridge National Lab., TN (USA)**	
	14:35519	CONF-890582–1
	14:35520	CONF-8511136–7
	14:35536	ORNL/FTR–3282
	14:35537	ORNL/FTR–3283
	14:35539	ORNL/TM–11176
	14:35763	CONF-890753–1
	14:35766	ORNL/FTR–3304
	14:35777	CONF-890601–1
	14:35778	CONF-890721–21
	14:35796	ORNL/FTR–2948
	14:35797	ORNL/FTR–3300
	14:35798	ORNL/Sub–88-21642/1
	14:35905	ORNL/TM–11054
	14:35961	ORNL/TM–11197
	14:35994	ORNL/tr–89/31
	14:36006	CONF-890721–23
	14:36012	ORNL/tr–89/28
	14:36027	CONF-890673–2
	14:36082	CONF-890721–11
	14:36083	CONF-890721–12
	14:36084	CONF-890721–15
	14:36094	CONF-890673–1
	14:36110	CONF-890546–7
	14:36125	ORNL/TM–11188
	14:36167	ORNL/FTR–3093
	14:36241	CONF-890659–1
	14:36242	CONF-890659–2
	14:36245	ORNL–6541/V1
	14:36274	CONF-8906146–1
	14:36370	ORNL/CON–283
	14:36375	CONF-890609–5
	14:36387	ORNL/FTR–3251
	14:36388	ORNL/FTR–3291
	14:36389	ORNL/FTR–3296
	14:36402	CONF-890793–1
	14:36416	ORNL/TM–11076
	14:36417	ORNL/TM–11114
	14:36473	CONF-890541–1
	14:36474	CONF-890721–22
	14:36475	CONF-890721–24
	14:36479	CONF-8906135–1
	14:36617	CONF-8906147–1
	14:36618	CONF-8906155–1
	14:36664	CONF-890771–1
	14:36665	CONF-8509443–1
	14:36706	CONF-851011–10
	14:36729	ORNL/FTR–3292
	14:36869	CONF-890721–14
	14:36880	ORNL–6525
	14:36984	CONF-890721–25
	14:37000	CONF-890744–1
	14:37001	CONF-8906133–1
	14:37014	ORNL/TM–10979
	14:37044	ORNL/FTR–3250
	14:37091	ORNL/FTR–3272
	14:37121	Y/DW–783/R1
	14:37133	CONF-890619–3
	14:37148	CONF-890769–2
	14:37173	ORNL/CDIAC–25
	14:37174	ORNL/FTR–2999
	14:37175	ORNL/FTR–3009
	14:37176	ORNL/FTR–3047
	14:37203	ORNL–6542
	14:37220	ORNL–6526/R4
	14:37227	DOE/OR/21400–T371
	14:37314	CONF-8901130–1
	14:37320	ORNL/TM–11145
	14:37334	ORNL/FTR–2942
	14:37335	ORNL/FTR–3043
	14:37343	CONF-8905157–1
	14:37344	CONF-8906137–1
	14:37345	CONF-8906140–1
	14:37381	ORNL/TM–10569
	14:37401	CONF-8906144–1
	14:37406	ORNL/FTR–2945
	14:37464	CONF-890618–2
	14:37465	CONF-890652–1
	14:37466	CONF-890703–10
	14:37467	CONF-890703–12
	14:37474	ORNL/FTR–3275
	14:37498	CONF-8905143–2
	14:37562	CONF-8903132–3
	14:37597	CONF-8904153–3
	14:37661	ORNL/FTR–2880
	14:37714	CONF-890403–25
	14:37715	CONF-890403–26
	14:37716	CONF-8906148–1
	14:37758	CONF-8904230–1
	14:37759	DOE/ER–0313/5
	14:37798	CONF-890744–2
	14:37799	CONF-8906112–1
	14:37800	CONF-8906150–1
	14:37808	ORNL/TM–10714
	14:37821	ORNL/FTR–3271
	14:35538	ORNL/Sub–83-43346/02
	14:36663	CONF-890627–2
	Lawrence Berkeley Lab., CA (USA)	
	14:36338	LBL–27130

Contract No.	Abstract No.	Report No.
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering	
	14:36011	NUREG/CR–5350
	Martin Marietta Energy Systems, Inc., Oak Ridge, TN (USA)	
	14:35772	CONF-881054–Vol.2
	14:35773	CONF-881054–Vol.3
	14:35775	CONF-881054–Vol.5
	Analysas Corp., Oak Ridge, TN (USA)	
	14:35771	CONF-881054–Vol.1
	14:35774	CONF-881054–Vol.4
	Oak Ridge National Lab., TN (USA). Data Systems Research and Development Program	
	14:37820	ORNL/DSRD–15
	14:37124	Published article
	14:37127	Published article
AC05-84OS21400	**Oak Ridge National Lab., TN (USA)**	
	14:35760	Y/TR–89/5
	14:35761	Y/TR–89/6
AC05-84OT21400	**Oak Ridge Gaseous Diffusion Plant, TN (USA)**	
	14:37819	K/DSRD–80
AC05-86OR21600	**Westinghouse Materials Co. of Ohio, Cincinnati, OH (USA). Feed Materials Production Center**	
	14:35754	FMPC–2174
AC06-76FF02170	**Hanford Engineering Development Lab., Richland, WA (USA)**	
	14:36028	HEDL-TME–81-30
	14:36029	HEDL-TME–83-12
AC06-76RL01830	**Electric Power Research Inst., Palo Alto, CA (USA)**	
	14:35785	EPRI-NP–5675
	Pacific Northwest Lab., Richland, WA (USA)	
	14:35654	DOE/RL/01830–H3
	14:35801	PNL–6821
	14:35802	PNL–6882
	14:35803	PNL–6898
	14:35804	PNL-SA–15641
	14:35805	PNL-SA–16454
	14:35806	PNL-SA–16743
	14:35856	PNL–6934
	14:36226	PNL–6920
	14:36340	PNL-SA–17006
	14:36393	PNL-SA–16585
	14:36580	PNL-SA–16211
	14:36846	PNL-SA–16621
	14:37141	PNL-SA–16622
	14:37142	PNL-SA–16629
	14:37143	PNL-SA–16630
	14:37223	PNL-SA–16782
	14:37276	PNL–6955
	14:37382	PNL–6450-20-HEDR
	14:37383	PNL–6822
	14:37475	PNL-SA–16839
	14:37662	PNL–6913
	14:37663	PNL-SA–16298
	14:36218	PNL–6797
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering	
	14:36166	NUREG/CR–5379-Vol.1
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Inspection and Safeguards	
	14:36162	NUREG/CR–5227-Suppl.1
	14:37233	Published article
AC06-76RL01857	**Oak Ridge National Lab., TN (USA)**	
	14:36663	CONF-890627–2
AC06-84ER40124	**Washington Univ., Seattle, WA (USA). Nuclear Physics Lab.**	
	14:37072	DOE/ER/40124–17
AC06-87RL10930	**Oak Ridge National Lab., TN (USA)**	
	14:35776	CONF-890470–
	Westinghouse Hanford Co., Richland, WA (USA)	
	14:35745	WHC-SA–0581
	14:35759	WHC-SA–0471
	14:35812	WHC-EP–0165
	14:35813	WHC-EP–0182-13
	14:35814	WHC-EP–0237
	14:35815	WHC-EP–0275
	14:36034	WHC-SA–0205
	14:36035	WHC-SA–0412
	14:36036	WHC-SA–0455
	14:36037	WHC-SA–0498
	14:36588	WHC-SA–0536
	Westinghouse Hanford Co., Shippingport, PA (USA)	
	14:35784	DOE/SSDP–0062
AC07-76ID01570	**Oak Ridge National Lab., TN (USA)**	
	14:36112	CONF-890470–
	Idaho National Engineering Lab., Idaho Falls, ID (USA)	
	14:36114	EGG-M–88332
	EG and G Idaho, Inc., Idaho Falls, ID (USA)	
	14:35989	EGG-M–88303
	14:35990	EGG-M–88448
	14:36144	EGG-M–88406
	USDOE Idaho Operations Office, Idaho Falls, ID (USA)	
	14:36412	DOE/ID–10204-2
AC07-84ID12435	**Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (USA)**	
	14:35816	WINCO–1007
AC07-88ID12698	**General Atomics, San Diego, CA (USA)**	
	14:36871	GA-A–19416
AC08-85NV10384	**Nevada Univ., Las Vegas, NV (USA). Water Resources Center**	
	14:35780	DOE/NV/10384–26
AC08-88NV10617	**EG and G Energy Measurements, Inc., Las Vegas, NV (USA)**	
	14:37135	EGG–10617-1033
	EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations	
	14:37207	EGG–10617-2015
AC09-76SR00001	**Savannah River Lab., Aiken, SC (USA)**	
	14:36126	DP-MS–88-143-Rev.1
AC09-89SR18035	**Savannah River Lab., Aiken, SC (USA)**	
	14:35818	WSRC-RP–89-288
	Westinghouse Savannah River Co., Aiken, SC (USA)	
	14:35817	WSRC-RP–89-87
	14:37255	DP-MS–88-185
AC11-89PN38014	**Bettis Atomic Power Lab., West Mifflin, PA (USA)**	
	14:37204	WAPD-RC/E(EE)–451
AC21-84FC10618	**North Dakota Univ., Grand Forks, ND (USA). Energy and Mineral Research Center**	
	14:37217	DOE/FC/10618–T1
AC21-86MC23077	**Foster Wheeler USA Corp., Clinton, NJ (USA)**	
	14:35524	DOE/MC/23077–2696
AC21-86MC23253	**Massachusetts Inst. of Tech., Cambridge, MA (USA)**	
	14:35581	DOE/MC/23253–2679

Contract No.	Abstract No.	Report No.
AC22-83PC60419	Management and Technical Consultants, Inc., Columbia, MD (USA)	
	14:35582	DOE/PC/60419–T10
	14:37197	Published article
AC22-85PC81012	Dravo Lime Co., Pittsburgh, PA (USA)	
	14:35958	DOE/PC/81012–T1-Pt.1-A
AC22-86PC91271	Missouri Univ., Rolla, MO (USA). Rock Mechanics and Explosives Research Center	
	14:35514	DOE/PC/91271–T22
AC22-87PC79856	Membrane Technology and Research, Inc., Menlo Park, CA (USA)	
	14:35957	DOE/PC/79856–T1
AC22-87PC79905	State Univ. of New York, Buffalo, NY (USA). Dept. of Chemical Engineering	
	14:35551	DOE/PC/79905–T7
AC22-87PC90274	TRW Defense and Space Systems Group, Redondo Beach, CA (USA). Applied Technology Div.	
	14:36347	DOE/PC/90274–T2
	TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div.	
	14:36348	DOE/PC/90274–T3
	TRW Space and Technology Group, Redondo Beach, CA (USA)	
	14:36346	DOE/PC/90274–T1
AC22-88PC88801	Auburn Univ., AL (USA). Dept. of Chemical Engineering	
	14:35526	DOE/PC/88801–T2
AC22-88PC88802	SRI International, Menlo Park, CA (USA)	
	14:35527	DOE/PC/88802–T1
AC22-88PC88827	Pennsylvania State Univ., University Park, PA (USA). Coll. of Earth and Mineral Sciences	
	14:35643	DOE/PC/88827–T2
AC22-88PC88886	Western Research Inst., Laramie, WY (USA)	
	14:35513	DOE/PC/88886–T2
AI01-85CE50112	National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center	
	14:36448	DOE/NASA–4105-4
AI01-88EH79050	Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center	
	14:37150	DOE/EH/79050–T1
AI05-87OR21697	Forest Service, Madison, WI (USA). Forest Products Lab.	
	14:36378	DOE/OR/21697–1
AI08-78ET44802	Geological Survey, Denver, CO (USA)	
	14:37407	USGS-BULL–1831
AS03-81ER40002	California Inst. of Tech., Pasadena, CA (USA)	
	14:37563	DOE/ER/40002–T1
AS03-81ER40004	California Univ., Berkeley, CA (USA). Dept. of Physics	
	14:37564	DOE/ER/40004–T2
	14:37565	DOE/ER/40004–T4
AS05-78ET52025	Georgia Inst. of Tech., Atlanta, GA (USA). Fusion Research Center	
	14:37720	GTFR–91
AT01-77ER72027	National Bureau of Standards, Washington, DC (USA). Surface Science Div.	
	14:36742	DOE/ER/72027–T2
FC22-83FE60149	National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)	
	14:35664	NIPER–403
FC22-88PC79808	West Virginia Univ., Morgantown, WV (USA). Dept. of Chemical Engineering	
	14:35525	DOE/PC/79808–T2
FG01-85FE60847	National Research Council, Washington, DC (USA). Committee on Chemical Engineering Frontiers-Research Needs and Opportunities	
	14:36244	NRC–9014514
FG01-86CE15270	Missouri Univ., Columbia, MO (USA). School of Forestry, Fisheries and Wildlife	
	14:35901	DOE/CE/15270–T10
FG01-86CE15289	San Diego State Univ., CA (USA). Dept. of Physics	
	14:35929	DOE/CE/15289–T1
FG01-87CE15316	Hydronetics, Inc., Chicago, IL (USA)	
	14:36870	DOE/CE/15316–T3
FG01-88CE26561	TECOGEN, Inc., Waltham, MA (USA)	
	14:36424	DOE/CE/26561–T2
FG02-78IR05106	Urban Consortium for Technology Initiatives (USA). Energy Task Force	
	14:36197	DOE/IR/05106–T54
	14:36253	DOE/IR/05106–T52
	14:36254	DOE/IR/05106–T81
	14:36361	DOE/IR/05106–T78
	14:36377	DOE/IR/05106–T68
	14:36403	DOE/IR/05106–T63
	14:36425	DOE/IR/05106–T53
	14:36426	DOE/IR/05106–T59
	14:36427	DOE/IR/05106–T60
	14:36428	DOE/IR/05106–T67
	14:36429	DOE/IR/05106–T76
	14:36430	DOE/IR/05106–T89
FG02-84CE40690	Mechanical Technology, Inc., Latham, NY (USA)	
	14:36577	MTI–88-TR-10
FG02-84ER13278	General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center	
	14:37324	DOE/ER/13278–2
FG02-84ER45131	Pittsburgh Univ., PA (USA)	
	14:37664	DOE/ER/45131–7
FG02-84ER45147	Indiana Univ., Bloomington, IN (USA)	
	14:36481	DOE/ER/45147–4
FG02-85ER13411	Utah Univ., Salt Lake City, UT (USA)	
	14:36737	DOE/ER/13411–4
FG02-86ER13564	Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Chemistry	
	14:36738	DOE/ER/13564–7
FG02-86ER13576	Purdue Univ., Lafayette, IN (USA). School of Electrical Engineering	
	14:37134	DOE/ER/13576–3
FG02-86ER13582	Colorado State Univ., Fort Collins, CO (USA)	
	14:36739	DOE/ER/13582–T2
FG02-86ER13584	Pennsylvania Univ., Philadelphia, PA (USA). Dept. of Chemistry	
	14:36740	DOE/ER/13584–4
FG02-86ER13603	Boston Univ., MA (USA). Dept. of Chemistry	
	14:36741	DOE/ER/13603–T1
FG02-86ER13612	Lehigh Univ., Bethlehem, PA (USA)	
	14:36736	CONF-890792–1
FG02-86ER45254	Pennsylvania Univ., Philadelphia, PA (USA). Board of Trustees	
	14:36667	DOE/ER/45254–3
FG02-86ER45262	Nebraska Univ., Lincoln, NE (USA)	
	14:36483	DOE/ER/45262–T1
FG02-86ER60399	Utah Univ., Salt Lake City, UT (USA). Dept. of Biology	
	14:37206	DOE/ER/60399–T2
FG02-87ER13785	National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)	
	14:35664	NIPER–403

Contract No.	Abstract No.	Report No.
FG02-87ER25026	Illinois Univ., Urbana, IL (USA). Dept. of Computer Science	
	14:37802	DOE/ER/25026–31
FG02-87ER25027	Argonne National Lab., IL (USA)	
	14:36867	CONF-8807172–1
FG02-87ER40315	Carnegie-Mellon Univ., Pittsburgh, PA (USA)	
	14:37503	DOE/ER/40315–156
	14:37504	DOE/ER/40315–158
	14:37505	DOE/ER/40315–159
	Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Physics	
	14:37108	DOE/ER/40315–157
	14:37496	DOE/ER/40315–160
FG02-87ER60556	Pennsylvania State Univ., University Park, PA (USA)	
	14:37326	DOE/ER/60556–T1
FG02-88ER60623	Rochester Univ., NY (USA). Dept. of Biophysics	
	14:37298	DOE/ER/60623–1
	14:37538	Published article
FG03-84ER45085	Stanford Univ., CA (USA)	
	14:36480	DOE/ER/45085–T1
FG03-86SF16306	Colorado State Univ., Fort Collins, CO (USA). Solar Energy Applications Lab.	
	14:35927	DOE/SF/16306–15
FG03-87ER40323	California Univ., Berkeley, CA (USA). Dept. of Physics	
	14:37506	DOE/ER/40323–T2
	14:37570	DOE/ER/40323–T1
FG03-88ER52151	California Univ., Los Angeles, CA (USA). Inst. for Plasma and Fusion Research	
	14:37744	UCLA/PPG–1237
FG05-83OR21390	Council of Great Lakes Governors, Chicago, IL (USA). Great Lakes Regional Biomass Energy Program	
	14:35902	DOE/OR/21390–T25
FG05-84ER13281	Texas Tech Univ., Lubbock, TX (USA). Dept. of Chemistry and Biochemistry	
	14:36707	DOE/ER/13281–5
FG05-85ER13339	Meharry Medical Coll., Nashville (USA). Dept. of Biochemistry	
	14:37325	DOE/ER/13339–5
FG05-85ER45186	Kentucky Univ., Lexington, KY (USA). Dept. of Materials Science and Engineering	
	14:36482	DOE/ER/45186–T1
FG05-85ER60290	Virginia Univ., Charlottesville, VA (USA). Dept. of Environmental Sciences	
	14:37165	DOE/ER/60290–T2
FG05-86ER13544	Kentucky Univ., Lexington, KY (USA). Dept. of Chemistry	
	14:36868	DOE/ER/13544–T2
FG05-87ER40374	Houston Univ., TX (USA)	
	14:37035	DOE/ER/40374–22
	14:37050	DOE/ER/40374–23
	Texas Univ., Houston, TX (USA)	
	14:37049	DOE/ER/40374–20
	Texas Univ., Houston, TX (USA). Dept. of Physics	
	14:37047	DOE/ER/40374–17
	Texas Accelerator Center, The Woodlands, TX (USA)	
	14:37034	DOE/ER/40374–21
	14:37048	DOE/ER/40374–18
	14:37073	DOE/ER/40374–19
FG05-87ER52147	Los Alamos National Lab., NM (USA)	
	14:36962	CONF-8904239–Summ.
	Maryland Univ., College Park, MD (USA). Lab. for Plasma Research	
	14:36961	CONF-8808146–17
FG05-88ER40481	Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Physics and Astronomy	
	14:37583	DOE/ER/40481–2
FG06-80ET34032	Studsvik Energiteknik AB, Nykoeping (Sweden)	
	14:35999	STUDSVIK-STSR–21
	14:36000	STUDSVIK-STSR–24
	14:36093	STUDSVIK-STSR–23-Rev.
	14:35996	STUDSVIK-STSR–11
	14:35997	STUDSVIK-STSR–17
	14:35998	STUDSVIK-STSR–19
	14:36013	STUDSVIK-STSR–12
FG06-87ER13796	Washington State Univ., Pullman, WA (USA). Dept. of Geology	
	14:37404	DOE/ER/13796–3
FG07-84ID12549	Geological Survey, Boise, ID (USA). Water Resources Div.	
	14:35938	DOE/ID/12549–1
FG21-87MC24219	Alaska Univ., Fairbanks, AK (USA)	
	14:35670	DOE/MC/24219–2705
FG22-86PC90502	Alabama Univ., University, AL (USA). Dept. of Chemistry	
	14:35555	DOE/PC/90502–11
FG22-86PC90504	Auburn Univ., AL (USA). Dept. of Chemical Engineering	
	14:35556	DOE/PC/90504–T10
FG22-86PC90507	California Univ., Berkeley, CA (USA). Coll. of Engineering	
	14:35557	DOE/PC/90507–T11
FG22-86PC90508	California Univ., Los Angeles, CA (USA). Dept. of Chemical Engineering	
	14:35558	DOE/PC/90508–T8
FG22-86PC90521	North Dakota Univ., Grand Forks, ND (USA). Dept. of Physics	
	14:35559	DOE/PC/90521–T10
FG22-86PC90523	Oklahoma State Univ., Stillwater, OK (USA). School of Chemical Engineering	
	14:35530	DOE/PC/90523–T4
FG22-86PC90753	Pittsburgh Univ., PA (USA). Dept. of Materials Science and Engineering	
	14:35586	DOE/PC/90753–T12
FG22-86PC90908	SRI International, Menlo Park, CA (USA)	
	14:35531	DOE/PC/90908–T6
	SRI International, Menlo Park, CA (USA). Chemical Physics Lab.	
	14:35521	CONF-8806136–1
FG22-86PC90956	Catholic Univ. of America, Washington, DC (USA)	
	14:35577	DOE/PC/90956–T8
FG22-86PC90958	Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering	
	14:35578	DOE/PC/90958–T8
FG22-87PC79907	California Univ., Riverside, CA (USA). Dept. of Chemistry	
	14:35552	DOE/PC/79907–T5
FG22-87PC79909	Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.	
	14:35583	DOE/PC/79909–6
FG22-87PC79914	Purdue Univ., Lafayette, IN (USA). School of Chemical Engineering	
	14:35553	DOE/PC/79914–T5
FG22-88PC88875	Kaiser Engineers, Inc., Pittsburgh, PA (USA)	
	14:35511	DOE/PC/88875–T1
	14:35512	DOE/PC/88875–T2
FG22-88PC88900	Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.	
	14:35584	DOE/PC/88900–4

Contract No.	Abstract No.	Report No.
FG22-88PC88910	**Arkansas Tech Univ., Russellville, AR (USA). Arkansas Mining and Mineral Resources Research Inst.**	
	14:35585	DOE/PC/88910–T1
FG22-88PC88920	**Idaho Univ., Moscow, ID (USA). Dept. of Metallurgical and Mining Engineering**	
	14:35528	DOE/PC/88920–T1
FG22-88PC88922	**Illinois Univ., Urbana, IL (USA). Dept. of Chemical Engineering**	
	14:35529	DOE/PC/88922–T1
FG22-88PC88925	**Grambling State Univ., LA (USA). Dept. of Chemistry**	
	14:35554	DOE/PC/88925–T1
FG22-89BC14204	**Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Petroleum Engineering**	
	14:35632	DOE/BC/14204–2
FG22-89BC14425	**Alabama Geological Survey, University, AL (USA)**	
	14:35600	DOE/BC/14425–1
W-31-109-ENG-38	**Cold Spring Harbor Lab. of Quantitative Biology, ME (USA)**	
	14:37389	CONF-8704370–
	14:37123	Published article
W-31109-ENG-38	**Argonne National Lab., IL (USA)**	
	14:35580	CONF-881202–4
	14:35779	CONF-8904232–1
	14:35823	CONF-890207–35
	14:35836	CONF-890565–7
	14:36085	CONF-890721–29
	14:36142	CONF-890721–31
	14:36143	CONF-890721–32
	14:36221	CONF-8905175–1
	14:36401	CONF-890790–2
	14:36422	CONF-890785–1
	14:36472	CONF-890468–11
	14:36476	CONF-8810377–1
	14:36477	CONF-8903140–1
	14:36478	CONF-8905168–1
	14:36615	CONF-890426–21
	14:36662	CONF-890435–4
	14:36867	CONF-8807172–1
	14:36976	CONF-881123–4
	14:36977	CONF-890604–12
	14:36978	CONF-890794–1
	14:36979	CONF-8906131–1
	14:37069	CONF-890335–209
	14:37070	CONF-890335–214
	14:37164	CONF-8905148–1
	14:37215	CONF-8805296–1
	14:37216	CONF-8905162–1
	14:37226	CONF-890207–34
	14:37560	ANL/NDM–111
	14:37572	CONF-8901115–3
	14:37585	ANL/NDM–112
	14:37639	CONF-8810118–10
	Stanford Linear Accelerator Center, Menlo Park, CA (USA)	
	14:37065	SLAC-PUB–4882
	Argonne National Lab., IL (USA). Mathematics and Computer Science Div.	
	14:37285	ANL/MCS-TM–132
	Argonne National Lab., IL (USA). High Energy Physics Div.	
	14:37545	ANL-HEP-CP–89-36
W-7405-ENG-36	**Los Alamos National Lab., NM (USA)**	
	14:35595	LA-UR–89-1633
	14:35756	LA-UR–89-2151
	14:35757	LA-UR–89-2152
	14:35768	LA–11517-M
	14:35790	LA-UR–89-2066
	14:35838	LA-UR–89-1558
	14:35839	LA-UR–89-2031
	14:35840	LA-UR–89-2047
	14:35940	LA-UR–89-1811
	14:35941	LA-UR–89-1878
	14:35942	LA-UR–89-2129
	14:36158	LA-UR–89-1178
	14:36236	LA-UR–89-1605
	14:36454	LA–11564-MS
	14:36456	LA–11553-MS
	14:36459	LA–11552-MS
	14:36572	LA-UR–89-1241
	14:36573	LA-UR–89-1423
	14:36638	LA–11577-MS
	14:36639	LA-UR–89-1777
	14:36640	LA-UR–89-2059
	14:36641	LA-UR–89-2141
	14:36642	LA-UR–89-2142
	14:36844	LA-UR–89-1883
	14:36878	LA-UR–89-2138
	14:36963	LA-UR–89-1932
	14:37002	LA-UR–89-489
	14:37003	LA-UR–89-1905
	14:37004	LA-UR–89-1911
	14:37005	LA-UR–89-1941
	14:37006	LA-UR–89-1990
	14:37007	LA-UR–89-1992
	14:37008	LA-UR–89-2097
	14:37009	LA-UR–89-2106
	14:37010	LA-UR–89-2137
	14:37011	LA-UR–89-2163
	14:37012	LA-UR–89-2169
	14:37013	LA-UR–89-2194
	14:37040	LA–11601-MS
	14:37041	LA-UR–89-1901
	14:37042	LA-UR–89-1903
	14:37043	LA-UR–89-1956
	14:37063	LA-UR–89-2089
	14:37088	LA-UR–89-965
	14:37089	LA-UR–89-2071
	14:37090	LA-UR–89-2080
	14:37137	LA–11525-MS
	14:37138	LA-UR–89-1951
	14:37139	LA-UR–89-2148
	14:37151	LA–11294-MS
	14:37410	LA-UR–89-1928
	14:37455	LA-UR–89-1592
	14:37456	LA-UR–89-1595
	14:37457	LA-UR–89-1848
	14:37473	LA-UR–89-2164
	14:37480	LA-UR–89-2165
	14:37481	LA-UR–89-2187
	14:37510	LA-UR–89-1751
	14:37511	LA-UR–89-1871
	14:37512	LA-UR–89-1892
	14:37526	LA-UR–89-1918
	14:37595	LA-UR–89-1649
	14:37685	LA-UR–89-1462
	14:37686	LA-UR–89-1967
	14:37687	LA-UR–89-2162
	14:37708	LA-UR–89-1745
	14:37734	LA-UR–89-2085
	14:37735	LA-UR–89-2088
	14:37736	LA-UR–89-2144
	14:37737	LA-UR–89-2188
	14:37770	LA-UR–89-2205
	14:37771	LA-UR–1909
	14:37805	LA–11614-MS
	14:37806	LA-UR–89-2087
	14:37807	LA-UR–89-2130
	Lawrence Livermore National Lab., CA (USA)	
	14:36587	UCRL–101189

Contract No.	Abstract No.	Report No.
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering	
	14:36091	NUREG/CR–5222
	Los Alamos National Lab., NM (USA). Center for National Security Studies	
	14:36457	LA–11598-MS
W-7405-ENG-48	**California Univ., Davis, CA (USA). Dept. of Civil Engineering**	
	14:37159	UCRL–21208
	Lawrence Livermore National Lab., CA (USA)	
	14:35731	UCID–16986-89-1
	14:35939	UCRL–21132
	14:36014	UCRL–100788
	14:36455	LLNL–9014513
	14:36460	UCRL–100268-Rev.1
	14:36847	UCID–21710
	14:36848	UCRL–21083
	14:36849	UCRL–53922
	14:36893	UCID–19592-Rev.5
	14:36894	UCRL–100757
	14:36966	UCRL–98850
	14:36982	UCID–21715
	14:36998	UCRL–101051
	14:37019	UCRL–100361
	14:37046	UCRL–100356
	14:37120	UCRL–53861-Vol.3
	14:37131	UCID–21731
	14:37147	UCRL–100969
	14:37153	UCRL–101058
	14:37158	UCID–20622-89-1
	14:37161	UCID–21634
	14:37195	UCRL–53903
	14:37196	UCRL–99927-Rev.1
	14:37303	UCRL–52000-89-4
	14:37486	UCID–21696
	14:37487	UCRL–21155
	14:37488	UCRL–100997
	14:37605	UCRL–101086
	14:37636	UCRL–99847
	14:37781	UCRL–101023
	14:37782	UCRL–101266
	14:37813	UCRL–100959
	14:37814	UCRL–101034
	14:37815	UCRL–101237
	Kahl Associates, Sacramento, CA (USA)	
	14:36233	UCRL–21175
	14:36605	Published article

Report Number Index

The report number index consists of the alphanumeric identifiers assigned to report literature as well as patent and conference literature cited in this publication. Entries provide the abstract number; the source(s) of availability of the document; the GPO file prefix for GPO depository library documents; the order number for OSTI and NTIS report ordering purposes; and, if the document was distributed under the DOE distribution program, the category number is shown for paper copy (PC), microfiche (MF), or no distribution (ND). These categories are included to assist DOE librarians in responding to requests for reports in their collections. The index also lists secondary numbers, with the corresponding abstract numbers and cross-references to other identifying numbers.

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
A65-IAAE–					
0012	14:37333	*See* CNIC–00139			
ACERR–					
1982	14:35517	Alberta Energy and Natural Resources, Information Centre, 9920-108 St., Edmonton, AB, Canada T5K 2M4; $N/C.			ND-000
1989	14:36238	Alberta Energy and Natural Resources, Information Centre, 9920-108 St., Edmonton, AB, Canada T5K 2M4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
AD-A–					
201236/7/XAB	14:37460	NTIS, PC A03/MF A01			ND-00
201358/9/XAB	14:36957	NTIS, PC A02/MF A01			ND-00
201483/5/XAB	14:36609	NTIS, PC A03/MF A01			ND-00
204630/8/XAB	14:36610	NTIS, PC A03/MF A01			ND-00
204648/0/XAB	14:36611	NTIS, PC A02/MF A01			ND-00
204687/8/XAB	14:36612	NTIS, PC A06/MF A01			ND-00
204693/6/XAB	14:37447	NTIS, PC A03/MF A01			ND-00
204699/3/XAB	14:37448	NTIS, PC A03/MF A01			ND-00
204716/5/XAB	14:37817	NTIS, PC A05/MF A01			ND-00
204724/9/XAB	14:37398	NTIS, PC A03/MF A01			ND-00
204736/3/XAB	14:36655	NTIS, PC A05/MF A01			ND-00
204737/1/XAB	14:37162	NTIS, PC A10/MF A01			ND-00
204742/1/XAB	14:36461	NTIS, PC A03/MF A01			ND-00
204745/4/XAB	14:37301	NTIS, PC A02/MF A01			ND-00
204750/4/XAB	14:37461	NTIS, PC A02/MF A01			ND-00
204796/7/XAB	14:35872	NTIS, PC A99/MF E04			ND-00
204800/7/XAB	14:36958	NTIS, PC A02/MF A01			ND-00
204822/1/XAB	14:36656	NTIS, PC A02/MF A01			ND-00
204823/9/XAB	14:37339	NTIS, PC A03/MF A01			ND-00
204855/1/XAB	14:37449	NTIS, PC A04/MF A01			ND-00
204860/1/XAB	14:37794	NTIS, PC A02/MF A01			ND-00
204877/5/XAB	14:36219	NTIS, PC A02/MF A01			ND-00
204880/9/XAB	14:36458	NTIS, PC A05/MF A01			ND-00
204881/7/XAB	14:36657	NTIS, PC A03/MF A01			ND-00
204902/1/XAB	14:37450	NTIS, PC A03/MF A01			ND-00
204903/9/XAB	14:37713	NTIS, PC A03/MF A01			ND-00
204907/0/XAB	14:37795	NTIS, PC A14/MF A01			ND-00
204914/6/XAB	14:36658	NTIS, PC A03/MF A01			ND-00
204915/3/XAB	14:37796	NTIS, PC A03/MF A01			ND-00
204916/1/XAB	14:37478	NTIS, PC A02/MF A01			ND-00
204929/4/XAB	14:37067	NTIS, PC A03/MF A01			ND-00
204932/8/XAB	14:36462	NTIS, PC A02/MF A01			ND-00
204962/5/XAB	14:36463	NTIS, PC A03/MF A01			ND-00
204964/1/XAB	14:36464	NTIS, PC A03/MF A01			ND-00
204965/8/XAB	14:36220	NTIS, PC A03/MF A01			ND-00
205006/0/XAB	14:35642	NTIS, PC A03/MF A01			ND-00
205007/8/XAB	14:37328	NTIS, PC A03/MF A01			ND-00
205013/6/XAB	14:36613	NTIS, PC A02/MF A01			ND-00
205015/1/XAB	14:37462	NTIS, PC A02/MF A01			ND-00
205051/6/XAB	14:36252	NTIS, PC A03/MF A01			ND-00
205059/9/XAB	14:36866	NTIS, PC A03/MF A01			ND-00
205076/3/XAB	14:35928	NTIS, PC A03/MF A01			ND-00
205080/5/XAB	14:36959	NTIS, PC A02/MF A01			ND-00

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
205096/1/XAB	14:37479	NTIS, PC A02/MF A01			ND-00
205141/5/XAB	14:36999	NTIS, PC A02/MF A01			ND-00
205145/6/XAB	14:37451	NTIS, PC A02/MF A01			ND-00
205161/3/XAB	14:37421	NTIS, PC A03/MF A01			ND-00
205162/1/XAB	14:37422	NTIS, PC A02/MF A01			ND-00
205182/9/XAB	14:37423	NTIS, PC A03/MF A01			ND-00
205184/5/XAB	14:37797	NTIS, PC A09/MF A01			ND-00
205193/6/XAB	14:37452	NTIS, PC A03/MF A01			ND-00
205197/7/XAB	14:37463	NTIS, PC A05/MF A01			ND-00
205221/5/XAB	14:37582	NTIS, PC A05/MF A01			ND-00
205232/2/XAB	14:37424	NTIS, PC A02/MF A01			ND-00
205233/0/XAB	14:36960	NTIS, PC A02/MF A01			ND-00
205234/8/XAB	14:36465	NTIS, PC A02/MF A01			ND-00
205280/1/XAB	14:37399	NTIS, PC A10/MF A01			ND-00
205281/9/XAB	14:35666	NTIS, PC A13/MF A01			ND-00
205808/9/XAB	14:37098	NTIS, PC A02/MF A01			ND-00
955407/2/XAB	14:37154	NTIS, PC A03/MF A01			ND-00
955408/0/XAB	14:37155	NTIS, PC A04/MF A01			ND-00
AE–					
1-252	14:36234	Alberta. Dept. of Energy, Information Centre, Petroleum Plaza Tower, 9915-108 St., Edmonton, AB, Canada T5K 2C9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
AECL–					
8632	14:36026	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89620211/JAW	MF-000
AERE-R–					
12978	14:37224	H.M. Stationery Office, London, price Pound 10.00			ND-000
13103	14:37099	H.M. Stationery Office, London, price Pound 8.00			ND-000
13159	14:37100	H.M. Stationery Office, London, price Pound 10.00			ND-000
13232	14:36614	H.M. Stationery Office, London, price Pound 18.75			ND-000
13399	14:37128	H.M. Stationery Office, London, price Pound 8.00			ND-000
AEROCHEM-TP–					
476	14:35687	*See* PB–89-140883/XAB			
AFGL-TR–					
89-0040	14:37447	*See* AD-A–204693/6/XAB			
89-0046	14:37421	*See* AD-A–205161/3/XAB			
89-0050	14:37422	*See* AD-A–205162/1/XAB			
AFRRI-SR–					
88-49	14:37098	*See* AD-A–205808/9/XAB			
AFWL-TR–					
88-92	14:36657	*See* AD-A–204881/7/XAB			
AGA–					
9013003	14:36466	American Gas Association, 1515 Wilson Blvd., Arlington, VA 22209			ND-000
AGT–					
010101/P7	14:36614	*See* AERE-R–13232			
AL–					
86-ALL-07(A-80)	14:35657	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
ANL-HEP-CP–					
89-36	14:37545	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013178/JAW	MF-414
ANL/MCS-TM–					
132	14:37285	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014163/JAW	MF-405
ANL/NDM–					
111	14:37560	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014084/JAW	MF-413
112	14:37585	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014105/JAW	MF-500
ANU-P–					
986	14:37606	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89619039/JAW	MF-000
988	14:37607	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89619040/JAW	MF-000
AOSTRA–					
8808	14:35689	Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.			ND-000
8808	14:35702	Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $150.00 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
BBC–					
TP-8328-E	14:36443	Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, Canada K1A 0N5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
BCH–					
8809	14:36371	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
BCH/RC–					
438-U-SOA	14:36372	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
438-U-SOA	14:36373	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
BCHPA–					
117-D-311	14:35968	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
BFLRF–					
232	14:35666	*See* AD-A–205281/9/XAB			
BFR-R–					
81-1988	14:36374	NTIS (US Sales Only), PC A03/MF A01		DE89776238/JAW	MF-000
97-1988	14:36421	NTIS (US Sales Only), PC A05/MF A01		DE89776232/JAW	MF-000
BHARC–					
700/88/018-Suppl.1	14:36162	*See* NUREG/CR–5227-Suppl.1			
BNL–					
41450	14:36128	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013569/JAW	MF-000
42049	14:37497	NTIS, PC A14/MF A01 - OSTI		DE89014420/JAW	MF-414
42333	14:37030	NTIS, PC A05/MF A01 - OSTI		DE89014499/JAW	MF-414
42627	14:37425	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014032/JAW	MF-412
42655	14:36659	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012974/JAW	MF-404
42768	14:37163	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014264/JAW	MF-402
42803	14:37596	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014190/JAW	MF-414
42831	14:36735	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013568/JAW	MF-401
52169	14:37068	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014582/JAW	PC-414
BNL-NUREG–					
42727	14:36129	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014711/JAW	MF-000
51708-Vol.4	14:36159	*See* NUREG/CR–3469-Vol.4			
51934-Vol.3	14:36160	*See* NUREG/CR–4409-Vol.3			
52191	14:36165	*See* NUREG/CR–5347			
52196	14:35794	*See* NUREG/CR–5363			
BONN-HE–					
89-1	14:37546	Bonn Univ. (Germany, F.R.). Physikalisches Inst.			ND-000
BR–					
82(11.100)	14:37249	*See* TR-EL–82-4/82(11.100)			
BUGRI–					
0003	14:35747	*See* CNIC–00214			
0004	14:36705	*See* CNIC–00231			
BUMINES-OFR–					
12-89	14:36237	*See* PB–89-168462/XAB			
CA/DOH/AIHL/SP–					
50	14:37188	*See* PB–89-168728/XAB			
CANMET–					
5174	14:36411	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
87-8	14:36239	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
8712	14:37022	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
8801	14:37132	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
MTL88-78	14:36469	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
SP88-19	14:36240	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
CBPF-NF–					
054/88	14:37516	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89612602/JAW	MF-000
060/88	14:37426	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89618785/JAW	MF-000
CCL–					
87081	14:36660	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
87082	14:36661	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
CE–					
02419	14:35862	*See* SU–7906			
02589	14:35702	*See* AOSTRA–8808			
02590	14:36238	*See* ACERR–1989			
02591	14:35691	*See* CU/FCE–8903			
02593	14:35689	*See* AOSTRA–8808			
02612	14:35967	*See* ZE–601G569			
02613	14:35966	*See* ZE–601G569			
02614	14:35965	*See* ZE–601G569			
02615	14:35964	*See* ZE–601G569			
02626	14:35974	*See* OH/RD–205-D-406			
02627	14:36674	*See* FCC–068-D-129-P2			
02628	14:35972	*See* IREQ–261-T-508			
02629	14:35970	*See* IREQ–137-D-374			
02632	14:35968	*See* BCHPA–117-D-311			
02634	14:36373	*See* BCH/RC–438-U-SOA			
02635	14:36372	*See* BCH/RC–438-U-SOA			
02637	14:35971	*See* IREQ–180-D-442			
02639	14:36399	*See* TIR–440-U-498			
02641	14:35618	*See* CHOA–8704			
02646	14:35647	*See* CHOA–8812			
02649	14:36380	*See* ETDE/CA-MS–8903			
02650	14:36255	*See* NOVA–1989			
02652	14:35517	*See* ACERR–1982			
02660	14:35722	*See* CHOA–8808			
02662	14:36339	*See* MPUB–99/89			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
02691	14:35677	*See* MPUB–7389			
02693	14:35683	*See* ERCB–D89-4			
CEA-CONF–					
9706	14:37156	NTIS (US Sales Only), PC A03/MF A01		DE89776471/JAW	MF-000
9767	14:37754	NTIS (US Sales Only), PC A03/MF A01		DE89789262/JAW	MF-000
CEA-DAS–					
539e	14:36130	NTIS (US Sales Only), PC A03/MF A01		DE89776470/JAW	MF-000
561	14:37198	NTIS (US Sales Only), PC A03/MF A01		DE89781564/JAW	MF-000
562	14:36131	NTIS (US Sales Only), PC A03/MF A01		DE89776469/JAW	MF-000
CEGB-RD/L–					
3306/R88	14:36001	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE89618366/JAW	MF-000
CEGB-TPRD/L–					
3259/R88	14:36704	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617891/JAW	MF-000
CERL-TR-E–					
89/06	14:36252	*See* AD-A–205051/6/XAB			
CFFTP-G–					
85041	14:37755	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89618772/JAW	MF-000
86045	14:37756	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89618746/JAW	MF-000
87004	14:37225	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE89619866/JAW	MF-000
87005	14:37757	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89619915/JAW	MF-000
87013	14:35770	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89620093/JAW	MF-000
CFS/NF–					
8710	14:35900	Northern Forestry Centre, 5320 - 122 Street, Edmonton, AB, Canada T6H 3S5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
CH–					
396/88	14:36025	*See* OEFZS-A–1355			
CHOA–					
8704	14:35618	Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.			ND-000
8808	14:35722	Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.			ND-000
8812	14:35647	Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, Canada T5J 3L8; $N/C.			ND-000
CNEA-N–					
2/87	14:37640	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89619917/JAW	MF-000
CNEA-NT–					
25/87	14:37403	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89619706/JAW	MF-000
3/88	14:37561	NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS		DE89620459/JAW	MF-000
6/88	14:37786	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE89620470/JAW	MF-000
CNEA-REPO–					
29	14:37403	*See* CNEA-NT–25/87			
CNEN-DR-GAPS-RA–					
01/88	14:36132	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE89620445/JAW	MF-000
CNIC–					
00139	14:37333	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613763/JAW	MF-000
00147	14:35753	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613219/JAW	MF-000
00214	14:35747	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613485/JAW	MF-000
00231	14:36705	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613061/JAW	MF-000
CNSS–					
20	14:36457	*See* LA–11598-MS			
CONF-7906193–		(Chemical Institute of Canada annual conference; Vancouver, Canada; 1 Jun 1979)			
	14:35862	*See* SU–7906			
CONF-7911203–		(9. symposium of geology in northeast; Natal, Brazil; Nov 1979)			
	14:36708	*See* INIS-BR–1542			
	14:36709	*See* INIS-BR–1544			
	14:37208	*See* INIS-BR–1539			
	14:37209	*See* INIS-BR–1540			
	14:37210	*See* INIS-BR–1541			
CONF-8210362–		(32. Canadian chemical engineering conference; Vancouver, Canada; 3-6 Oct 1982)			
	14:35517	*See* ACERR–1982			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8406162–		(CEBAF summer workshop; Newport News, VA, USA; 25-29 Jun 1984)			
	14:37031	*See* DOE/ER/40150–79			
CONF-8509443–		(8. enzyme engineering; Helsingor, Denmark; 22-27 Sep 1985)			
1	14:36665	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014194/JAW	MF-372
CONF-851011–		(4. symposium on separation science and technology for energy applications; Knoxville, Tennessee, USA; 20-24 Oct 1985)			
10	14:36706	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014192/JAW	MF-401
CONF-8511136–		(Direct liquefaction contractors conference; Pittsburgh, Pennsylvania, USA; 19-21 Nov 1985)			
7	14:35520	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014193/JAW	MF-108
CONF-860104–		(3. Berkeley conference on elevated temperature corrosion-erosion-wear of materials; Berkeley, CA, USA; 27-29 Jan 1986)			
	14:36589	National Assoc. of Corrosion Engineers, P.O. Box 218340, Houston, TX 77218			
CONF-8604413–		(Workshop on CEBAF spectrometer magnet design and technology; Newport News, VA, USA; 7-11 Apr 1986)			
	14:37107	*See* DOE/ER/40150–82			
CONF-8606241–		(3. Continuous Electron Beam Accelerator Facility summer school; Newport News, VA, USA; 23-27 Jun 1986)			
	14:37569	*See* DOE/ER/40150–81			
CONF-860652–		(7. topical meeting on the technology of fusion energy; Reno, Nevada, USA; 15-19 Jun 1986)			
	14:37756	*See* CFFTP-G–86045			
CONF-8611288–		(IEA and AFBC workshop on FBC mathematical modelling; Liege, France; 7 Nov 1986)			
	14:35593	*See* STEV-FBT–89-2			
CONF-8611291–		(Perspectives on land modelling; Toronto, Canada; 17-20 Nov 1986)			
	14:36235	*See* EC–1988			
CONF-861207–		(Materials Research Society fall meeting; Boston, MA, USA; 1-5 Dec 1986)			
	14:36680	Materials Research Society, 9800 Mc Knight Rd., Suite 327, Pittsburgh, PA 15237			
CONF-861277–		(Parity violation workshop - CEBAF; Newport News, VA, USA; 11-12 Dec 1986)			
	14:37502	*See* DOE/ER/40150–74			
CONF-870153–		(25. international winter meeting on nuclear physics; Bormio, Italy; 19-24 Jan 1987)			
	14:37635	*See* Lund-MPh–87/06			
CONF-8703319–		(Moriond meeting on progress in electroweak interactions; Les Arcs, France; 8 Mar 1987)			
	14:37575	*See* LAL–87-35			
CONF-870410–		(193. national meeting of the American Chemical Society; Denver, Colorado, USA; 5-10 Apr 1987)			
	14:35770	*See* CFFTP-G–87013			
CONF-8704381–		(4. quarterly meeting of the Canadian Heavy Oil Association; Calgary, Canada; 28 Apr 1987)			
	14:35618	*See* CHOA–8704			
CONF-8705216–		(2. symposium on electrode materials and processes for energy conversion and storage; Philadelphia, PA, USA; 11-15 May 1987)			
	14:36223	The Electrochemical Society, 10 South Main St., Pennington, NJ 08534			
CONF-8705358–		(Canadian Nuclear Society annual meeting; Montreal, Canada; 18-22 May 1987)			
	14:37757	*See* CFFTP-G–87005			
CONF-8705377–		(9. symposium on fluid inclusions; Oporto, Portugal; 4-6 May 1987)			
	14:37416	*See* NEI-DK–167			
CONF-8705380–		(Technology transfer workshop [for] northern water quality monitoring; Yellowknife, Canada; 4-7 May 1987)			
	14:37256	*See* EC/IWD–7			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8706200–		(CEBAF summer workshop; Newport News, VA, USA; 22-26 Jun 1987)			
	14:37567	*See* DOE/ER/40150–75			
CONF-8706388–		(10. All-Union seminar on linear accelerators; Kharkov, Ukrainian SSR; 2-4 Jun 1987)			
	14:37419	*See* INIS-SU–87/A			
CONF-8706396–		(10. nuclear physics workshop; Buenos Aires, Argentina; 23-26 Jun 1987)			
	14:37561	*See* CNEA-NT–3/88			
CONF-8707208–		(U.S. Particle Accelerator School: physics of particle accelerators; U.S. Particle Accelerator School; Batavia, Illinois, USA; Ithaca, New York, USA; 20 Jul - 14 aug 1987; aug 1988)			
Vol.1	14:37026	American Institute of Physics, Conference Proceedings, 335 E. 45th Street, New York, NY 10017			ND-414
Vol.2	14:37027	American Institute of Physics, Conference Proceedings, 335 E. 45th Street, New York, NY 10017			ND-414
CONF-8707217–		(9. conference of Czechoslovak physicists; Pardubice, Czechoslovakia; 6-10 Jul 1987)			
	14:37678	*See* INIS-mf–11456			
CONF-870832–		(Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry: present and future; Snowbird, Utah, USA; 31 Aug - 2 sep 1987)			
	14:36109				
	14:37816				
CONF-8708339–		(11. AINSE radiation biology conference; Lucas Heights, Australia; 24-25 Aug 1987)			
	14:37347	*See* INIS-mf–11448			
CONF-8708341–		(4. International symposium on selected topics in statistical mechanics; Dubna, USSR; 25-29 Aug 1987)			
	14:37702	*See* JINR-D–17-88-95			
CONF-870835–		(72. annual meeting of the Ecological Society of America; Columbus, OH, USA; 9-14 Aug 1987)			
	14:35916				
	14:35917				
	14:35918				
	14:35919				
	14:35920				
	14:35921				
	14:35922				
	14:35923				
	14:35924				
	14:37211				
	14:37212				
	14:37213				
	14:37214				
	14:37277				
	14:37336				
	14:37337				
	14:37338				
	14:37385				
	14:37397				
CONF-8709200–		(1. topical meeting on giant resonance excitation in heavy-ion collisions; Legnaro, Italy; 21-25 Sep 1987)			
	14:37628	*See* IPNO-DRE–87-40			
CONF-8709412–		(Conference on ion formation from organic solids; Munster, DE, USA; 21-22 Sep 1987)			
	14:37471	*See* IPNO-DRE–87-33(7)			
CONF-8709439–		(17. Congreso de quimicos Teoricos de Expresion Latina; Peniscola, Spain; 20-25 Sep 1987)			
	14:36703	*See* LYCEN–8754			
CONF-8709440–		(5. International conference on nuclei far from stability; Rosseau Lake, CA, USA; 14-19 Sep 1987)			
	14:37581	*See* ISN–87-87			
	14:37589	*See* ISN–87-88			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8710145–		(Biochemical conversion program annual review meeting; Golden, Colorado, USA; 13-15 Oct 1987)			
	14:35900	*See* CFS/NF–8710			
CONF-8710231–		(8. international school on nuclear physics, neutron physics and nuclear energy; Varna, Bulgaria; 19-28 Oct 1987)			
	14:37629	*See* IPNO-DRE–87-42			
CONF-871038–		(5. symposium on separation science and technology for energy applications; Knoxville, TN, USA; 26-29 Oct 1987)			
	14:35822				
CONF-8710469–		(Conference on decentral dual-purpose power plants; Moltkes Palae, Denmark; 26 Oct 1987)			
	14:36344	*See* NEI-DK–172			
CONF-8801117–		(High intensity laser matter interactions; Los Angeles, CA, USA; 12-13 Jan 1988)			
	14:37745	SPIE Society of Photo-Optical Instrumentation Engineers, 1022 19 St., P.O. Box 10, Bellingham, WA 98227			
CONF-8801121–		(Nonlinear optical beam manipulation, beam combining, and atmospheric propagation; Los Angeles, California, USA; 11-14 Jan 1988)			
	14:36967	SPIE Society of Photo-Optical Instrumentation Engineers, 1022 19 St., P.O. Box 10, Bellingham, WA 98227			
CONF-880195–		(26. international winter meeting on nuclear physics; Bormio, Italy; 25-29 Jan 1988)			
	14:37586	*See* CRN-PN–88-02			
CONF-880301–		(Annual meeting of the American Association of Petroleum Geologists; Houston, TX, USA; 20-23 Mar 1988)			
	14:35602				
	14:35634	American Association of Petroleum Geologists, P.O. Box 979, Tulsa, OK 74101			
CONF-8803109–		(23. Rencontre de Moriond conference: electroweak interactions and unified theories; Les Arcs, France; 6-12 Mar 1988)			
	14:37509	*See* LAL–88-14			
	14:37544	*See* LAL–88-36			
	14:37553	*See* LAL–88-30			
	14:37554	*See* LAL–88-37			
CONF-8803164–		(Conference on energy privatisation; Guildford, UK; 2 Mar 1988)			
	14:36271	*See* SEEDS-DP–39			
CONF-8803214–		(Lake Louise Winter Institute meeting; Alberta, CA, USA; 6-12 Mar 1988)			
	14:37543	*See* LAL–88-29			
CONF-8803218–		(Welding '88 - 3. conference on nondestructive testing of welded joints; Brno, Czechoslovakia; 3-4 Mar 1988)			
	14:36990	*See* INIS-mf–11451			
CONF-8803221–		(Symposium on HIFAR - construction and initial operation; Lucas Heights, Australia; 11 Mar 1988)			
	14:36116	*See* INIS-mf–11446			
CONF-8804184–		(9. workshop on grand unification; Aix-Les-Bains, France; 27-30 Apr 1988)			
	14:37706	*See* LAL–88-33			
	14:37707	*See* LAL–88-34			
CONF-8804284–		(10. working group meeting of representatives of RCA Member States; Beijing, China; 11-14 Apr 1988)			
	14:37788	*See* INIS-mf–11449			
CONF-880506–		(American Nuclear Society topical meeting on the safety of next generation power reactors; Seattle, WA, USA; 1-6 May 1988)			
29	14:36034	*See* WHC-SA–0205			
CONF-8805291–		(Offshore Northern Seas '88; Stavanger, Norway; 23-26 May 1988)			
	14:35656	*See* NEI-NO–85			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8805296–		(First regional workshop on integrated monitoring; New Brunswick, Canada; 31 May - 2 jun 1988)			
1	14:37215	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013193/JAW	MF-402
CONF-8805304–		(5. information systems technology conference; Fredericton, Canada; 18-19 May 1988)			
	14:37823	*See* SSC/ISD–8805			
CONF-8806104–		(International workshop on atomic physics for ion driven fusion; Orsay, France; 20-24 Jun 1988)			
	14:37573	*See* IPNO-DRE–88-24			
CONF-8806136–		(American Chemical Society Division of Fuel Chemistry meeting; Toronto, Canada; 5-10 Jun 1988)			
	14:35641				
1	14:35521	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012984/JAW	MF-108
CONF-8806261–		(Chinese/American symposium on energy markets and the future of energy demand; Nanjing, China; 22-24 Jun 1988)			
	14:36258	*See* LBL–26260			
1	14:36384	*See* LBL–25363			
CONF-880631–		(29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA; 26-29 Jun 1988)			
	14:37029				
CONF-8806312–		(Symposium on coal-derived fuels - coprocessing; Toronto, Canada; 5-10 Jun 1988)			
	14:35546				
CONF-8806378–		(International workshop on principles for disposal of radioactive and other hazardous wastes; Stockholm, Sweden; 7-10 Jun 1988)			
	14:35791	*See* NEI-SE–35			
CONF-8806381–		(3. annual Hampton University Graduate Studies (HUGS) summer school; Newport News, VA, USA; 6-24 Jun 1988)			
	14:37568	*See* DOE/ER/40150–78			
CONF-880688–		(Summer workshop of the continuous electron beam accelerator facility; Newport News, VA, USA; 20-24 Jun 1988)			
	14:37566	*See* DOE/ER/40150–73			
CONF-8807136–		(ISEC '88: international solvent extraction conference; Moscow, USSR; 18-24 Jul 1988)			
	14:36715	*See* INIS-SU–97			
CONF-8807155–		(4. international symposium on small particles and inorganic clusters (ISSPIC-4); Aix-en-Province, France; 5-9 Jul 1988)			
	14:37477				
	14:37697				
CONF-880717–		(Banff summer institute on particles and fields; NATO Advanced Study Institute on techniques and concepts of high energy physics; Banff, Canada; St. Croix, Virgin Islands (U.S.); 14-27 Aug 1988; 14-25 jul 1988)			
1	14:37513	*See* SLAC-PUB–4816			
CONF-8807171–		(Challenges to the nonproliferation regime into the 21st century; Los Alamos, NM, USA; 20-21 Jul 1988)			
Summs.	14:36454	*See* LA–11564-MS			
CONF-8807172–		(10. Dundee conference on differential equations; Dundee, UK; 4-8 Jul 1988)			
1	14:36867	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013629/JAW	MF-401
CONF-8807177–		(2. workshop on LIE methods in optics; Morelos, Mexico; 19-22 Jul 1988)			
1	14:37709	*See* LBL–25609			
CONF-880747–		(16. annual SLAC summer institute on particles physics; Stanford, CA, USA; 18-29 Jul 1988)			
7	14:37440	*See* LBL–26210			
CONF-880787–		(3. international symposium on the synthesis and applications of isotopically labeled compounds; Innsbruck, Austria; 17-21 Jul 1988)			
8	14:36845	*See* LBL–25559			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-880807–		(4. UNITAR/UNDP international conference on heavy crude and tar sands; Edmonton, Canada; 7-12 Aug 1988)			
	14:35689	*See* AOSTRA–8808			
	14:35702	*See* AOSTRA–8808			
CONF-880812–		(Applied superconductivity conference; San Francisco, CA, USA; 21-25 Aug 1988)			
	14:36653				
	14:36654				
	14:36895				
	14:36896				
	14:36897				
	14:36898				
	14:36899				
	14:36900				
	14:36901				
	14:36902				
	14:36903				
	14:36904				
	14:36905				
	14:36906				
	14:36907				
	14:36908				
	14:36909				
	14:36910				
	14:36911				
	14:36912				
	14:36913				
	14:36914				
	14:36915				
	14:36916				
	14:36917				
	14:36918				
	14:36919				
	14:36920				
	14:36921				
	14:36922				
	14:36923				
	14:36924				
	14:36925				
	14:36926				
	14:36927				
	14:36928				
	14:36929				
	14:36930				
	14:36931				
	14:36932				
	14:36933				
	14:36934				
	14:36935				
	14:36936				
	14:36937				
	14:36938				
	14:36939				
	14:36940				
	14:36941				
	14:36942				
	14:36943				
	14:36944				
	14:36945				
	14:36946				
	14:36947				
	14:36948				
	14:36949				
	14:36950				
	14:36951				
	14:36952				
	14:36953				
	14:36954				
	14:36955				
	14:36956				

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8808146–		(10. international free-electron laser conference; Jerusalem, Israel; 29 Aug - 2 sep 1988)			
16	14:36966	*See* UCRL–98850			
17	14:36961	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014759/JAW	MF-420
CONF-880815–		(20. DOE/NRC nuclear air cleaning conference; Boston, Massachusetts, USA; 22-25 Aug 1988)			
Vol.1	14:37200	*See* NUREG/CP–0098-Vol.1			
Vol.2	14:37201	*See* NUREG/CP–0098-Vol.2			
Vol.3	14:37202	*See* NUREG/CP–0098-Vol.3			
CONF-8808232–		(Banff summer institute on particles and fields; NATO Advanced Study Institute on techniques and concepts of high energy physics; Banff, Canada; St. Croix, Virgin Islands (U.S.); 14-27 Aug 1988; 14-25 jul 1988)			
1	14:37513	*See* SLAC-PUB–4816			
CONF-8808234–		(U.S. Particle Accelerator School: physics of particle accelerators; U.S. Particle Accelerator School; Batavia, Illinois, USA; Ithaca, New York, USA; 20 Jul - 14 aug 1987; aug 1988)			
Vol.1-Exc.	14:37026	*See* CONF-8707208–Vol.1			
Vol.2-Exc.	14:37027	*See* CONF-8707208–Vol.2			
CONF-8808237–		(Thermal well completions seminar; Edmonton, Canada; 11 Aug 1988)			
	14:35722	*See* CHOA–8808			
CONF-880861–		(Workshop on rare K decays and CP violation; Upton, NY, USA; 25-27 Aug 1988)			
Vugraphs	14:37497	*See* BNL–42049			
CONF-880862–		(BNL workshop on glueballs, hybrids and exotic hadrons; Upton, New York, USA; 29 Aug - 1 sep 1988)			
	14:37490	American Institute of Physics, Conference Proceedings, 335 E. 45th Street, New York, NY 10017			ND-414
	14:37515				
CONF-880903–		(Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA; 11-15 Sep 1988)			
55	14:35804	*See* PNL-SA–15641			
CONF-880906–		(7. international conference on radiation shielding; Bournemouth, UK; 12-16 Sep 1988)			
	14:37156	*See* CEA-CONF–9706			
CONF-8809118–		(20. summer school on nuclear structure studies by means of nuclear reactions: heavy ions in nuclear and atomic physics; Mikolajki, Poland; 2-11 Sep 1988)			
	14:37603	*See* HMI-B–463			
CONF-8809218–		(9. European symposium on antiproton-proton interactions and fundamental symmetries; Mainz, Germany, F.R.; 5-9 Sep 1988)			
3	14:37505	*See* DOE/ER/40315–159			
CONF-880929–		(15. symposium on fusion technology; Utrecht, Netherlands; 19-23 Sep 1988)			
	14:37754	*See* CEA-CONF–9767			
CONF-8809359–		(International school of elementary particle physics; Duilovo-Split, Yugoslavia; 18 Sep - 2 oct 1988)			
	14:37439	*See* LAL–88-41			
CONF-8809360–		(World material congress; Chicago, Illinois, USA; 24-26 Sep 1988)			
1	14:36575	*See* LBL–26942			
CONF-8809364–		(Sessions on materials processing in space; Chicago, IL, USA; 25-28 Sep 1988)			
1	14:37781	*See* UCRL–101023			
CONF-8809365–		(2. technical meeting on sewage gas utilisation for cogeneration; Muehlheim/Main, Germany, F.R.; 27 Sep 1988)			
	14:36423	NTIS (US Sales Only), PC A07/MF A01		DE89788277/JAW	MF-000
CONF-880983–		(8. international symposium on high energy spin physics; Minneapolis, MN, USA; 12-17 Sep 1988)			
38	14:37504	*See* DOE/ER/40315–158			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8810118–		(Workshop on momentum distributions; Argonne, Illinois, USA; 24-26 Oct 1988)			
10	14:37639	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014678/JAW	MF-401
CONF-881014–		(International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon, France; 2-7 Oct 1988)			
	14:36130	*See* CEA-DAS–539e			
CONF-8810176–		(JOWOG 22D joining subgroup; Aldermasten, UK; 4-6 Oct 1988)			
5	14:36583	*See* SAND–88-0973C			
CONF-8810261–		(International workshop on nuclear dynamics at medium and high energies; Bad Honnef, Germany, F.R.; 10-14 Oct 1988)			
	14:37600				
	14:37762	*See* GANIL-P–88-16			
CONF-8810351–		(Meeting on uranium; Montpellier, France; 10-12 Oct 1988)			
	14:37198	*See* CEA-DAS–561			
CONF-8810372–		(Advances in physics; Constanta, Romania; 6-8 Oct 1988)			
	14:37418	*See* INIS-mf–11440			
CONF-8810375–		(Reunion de l'AIEA sur le comportement ultime des enceintes; Moscou, USSR; 17-21 Oct 1988)			
	14:36131	*See* CEA-DAS–562			
CONF-8810377–		(Symposium on interface structure and reactions; San Francisco, California, USA; 23-26 Oct 1988)			
1	14:36476	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013186/JAW	MF-404
CONF-881054–		(4. annual DOE model conference; Oak Ridge, TN, USA; 3-7 Oct 1988)			
Vol.1	14:35771	NTIS, PC A15/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014700/JAW	MF-721
Vol.2	14:35772	NTIS, PC A13/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014701/JAW	MF-721
Vol.3	14:35773	NTIS, PC A14/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014702/JAW	MF-721
Vol.4	14:35774	NTIS, PC A15/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014703/JAW	MF-721
Vol.5	14:35775	NTIS, PC A13/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014704/JAW	MF-721
CONF-881103–		(IEEE nuclear science symposium; Orlando, FL, USA; 9-11 Nov 1988)			
63	14:37109	*See* DOE/ER/40372–T1			
64	14:37103	*See* DOE/ER/03130–41C			
CONF-8811104–		(Meeting on bioprocessing research for energy applications; Alexandria, VA, USA; 2-4 Nov 1988)			
Summs.	14:35905	*See* ORNL/TM–11054			
CONF-8811152–		(EULIMA workshop on the potential value of light ion beam therapy; Nice, France; 3-5 Nov 1988)			
	14:37574	*See* IPNO-DRE–88-37			
CONF-8811188–		(International symposium on mine planning and equipment selection; Calgary, Canada; 3-4 Nov 1988)			
	14:35647	*See* CHOA–8812			
CONF-881120–		(ASME winter annual meeting; Chicago, IL, US; November 28, 1988)			
10	14:36574	*See* LBL–25831			
CONF-881123–		(3. international symposium on liquid-solid flows (WAM); Chicago, IL, USA; 28 Nov - 2 dec 1988)			
4	14:36976	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013645/JAW	MF-350
CONF-881131–		(Society for Reactor Safety meeting on research to increase the safety of nuclear power plants; Cologne, Germany, F.R.; 3-4 Nov 1988)			
	14:36149	*See* INIS-mf–11940			
	14:36150	*See* INIS-mf–11941			
	14:36151	*See* INIS-mf–11942			
	14:36152	*See* INIS-mf–11943			
	14:36153	*See* INIS-mf–11944			
CONF-881143–		(American Institute of Chemical Engineers annual meeting; Washington, D.C., USA; 27 Nov - 2 dec 1988)			
7	14:35805	*See* PNL-SA–16454			
CONF-881202–		(5. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, Florida, USA; 12-14 Dec 1988)			
4	14:35580	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013648/JAW	MF-103

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-881292–		(3. Mexican school of particles and fields; Cuernavaca, Mexico; 5-16 Dec 1988)			
1	14:37532	*See* SLAC-PUB–4955			
CONF-881294–		(Information and automation technology: serving electric utility customers in the 1990's; Scottsdale, AZ, USA; 5-7 Dec 1988)			
	14:36257	*See* EPRI-CU–6400			
CONF-890103–		(6. symposium on space nuclear power systems; Albuquerque, New Mexico, USA; 9-12 Jan 1989)			
11	14:36128	*See* BNL–41450			
CONF-8901115–		(Topical conference on electronuclear physics with internal targets; Stanford, California, USA; 9-12 Jan 1989)			
2	14:37531	*See* SLAC-PUB–4881			
3	14:37572	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014632/JAW	MF-411
CONF-8901118–		(Workshop on triggering and data acquisition for experiments at the Superconducting Super Collider; Toronto, Canada; 16-19 Jan 1989)			
4	14:37104	*See* DOE/ER/03130–43C			
CONF-8901130–		(UCLA symposia on molecular and cellular biology: transgenic models in medicine and agriculture; Taos, NM, USA; 28 Jan - 3 feb 1989)			
1	14:37314	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013053/JAW	MF-408
CONF-890178–		(Ethical issues of military research; Washington, D.C., USA; 26-29 Jan 1989)			
1-Rev.1	14:36460	*See* UCRL–100268-Rev.1			
CONF-890198–		(International conference on nuclear reaction mechanism; Calcutta, India; 3-9 Jan 1989)			
2	14:37620	*See* INFN/BE–89/3			
CONF-890207–		(Waste management '89; Tucson, Arizona, USA; 26 Feb - 2 mar 1989)			
34	14:37226	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013650/JAW	MF-630
35	14:35823	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013651/JAW	MF-802
CONF-8902105–		(DOE quality conference: managing for quality in a changing environment; Albuquerque, New Mexico, USA; 14-16 Feb 1989)			
Summs.	14:37787	NTIS, PC A12/MF A01 - OSTI		DE89012866/JAW	MF-600
CONF-8902110–		(2. international symposium on the 4th family of quarks and leptons; Santa Monica, California, USA; 23-25 Feb 1989)			
1	14:37534	*See* SLAC-PUB–4983			
2	14:37533	*See* SLAC-PUB–4973			
CONF-8902113–		(Cellular automata and modeling of complex physical systems; Les Houches, France; 21 Feb - 2 mar 1989)			
1	14:37488	*See* UCRL–100997			
CONF-8902115–		(1. geospace environment modeling (GEM) workshop; San Diego, California, USA; 19-21 Feb 1989)			
1	14:37456	*See* LA-UR–89-1595			
CONF-8902117–		(Symposium on physical metallurgh of controlled expansion invar- type alloys; Las Vegas, NV, USA; 28 Feb 1989)			
1	14:36580	*See* PNL-SA–16211			
CONF-890247–		(5. European symposium on semiconductor detectors: new developments on radiation detectors; Munich, Germany, F.R.; 21-23 Feb 1989)			
3	14:37096	*See* SLAC-PUB–4961			
CONF-890270–		(International industrial symposium on the super collider; New Orleans, Louisiana, USA; 8-10 Feb 1989)			
20	14:37119	*See* SLAC-PUB–4942			
CONF-890299–		(AHF accelerator design workshop; Los Alamos, NM, USA; 20-25 Feb 1989)			
11	14:37063	*See* LA-UR–89-2089			
12	14:37042	*See* LA-UR–89-1903			
13	14:37043	*See* LA-UR–89-1956			
14	14:37041	*See* LA-UR–89-1901			
CONF-890310–		(7. international conference on fracture (ICF-7); Houston, Texas, USA; 20-24 Mar 1989)			
	14:36545	*See* FhG-IWM-W–2/88			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8903111–		(Lunar planetary science conference; Houston, Texas, USA; 12-18 Mar 1989)			
4	14:37425	*See* BNL–42627			
CONF-8903126–		(6. annual heavy oil and oil sands technical symposium; Calgary, Canada; 8 Mar 1989)			
	14:35691	*See* CU/FCE–8903			
CONF-8903128–		(International conference on intelligent materials; Tsukuba, Japan; Mar 1989)			
1	14:36659	*See* BNL–42655			
CONF-8903130–		(Strings '89 conference; College Station, TX, USA; 13-18 Mar 1989)			
1	14:37545	*See* ANL-HEP-CP–89-36			
CONF-8903131–		(Chapman conference on the physics of magnetic flux ropes; Hamilton, Bermuda; 27-31 Mar 1989)			
1	14:37455	*See* LA-UR–89-1592			
CONF-8903132–		(24. Rencontres de Moriond: electroweak interactions and unified theories; Les Arcs, France; 5-12 Mar 1989)			
1	14:37514	*See* SLAC-PUB–4985			
2	14:37438	*See* FNAL/C–89/112-A			
3	14:37562	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013007/JAW	MF-414
4	14:37548	*See* FNAL/C–89/116-T			
5	14:37512	*See* LA-UR–89-1892			
6	14:37526	*See* LA-UR–89-1918			
CONF-8903134–		(Circum-Pacific energy and minerals conference; San Jose, Costa Rica; 5-8 Mar 1989)			
2	14:35940	*See* LA-UR–89-1811			
CONF-8903135–		(Costa Rica symposium; San Jose, Costa Rica; 6-9 Mar 1989)			
1	14:35595	*See* LA-UR–89-1633			
2	14:36236	*See* LA-UR–89-1605			
CONF-8903138–		(ILL workshop on fundamental physics with slow neutrons; Grenoble, France; 8-11 Mar 1989)			
	14:37507	*See* GSI–89-33(prepr.)			
CONF-8903140–		(Les Houches international workshop on number theory and physics; Les Houches, France; 7-16 Mar 1989)			
1	14:36477	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014676/JAW	MF-404
CONF-8903141–		(NATO ISI partially integrable systems; Les Houches, France; Mar 1989)			
1	14:37687	*See* LA-UR–89-2162			
CONF-890335–		(13. particle accelerator conference; Chicago, Illinois, USA; 20-23 Mar 1989)			
203	14:37065	*See* SLAC-PUB–4882			
204	14:37066	*See* SLAC-PUB–4928			
205	14:37095	*See* SLAC-PUB–4926			
207	14:37094	*See* SLAC-PUB–4893			
209	14:37069	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014639/JAW	MF-413
212	14:37051	*See* FNAL/C–89/115			
213	14:37074	*See* FNAL/C–89/126			
214	14:37070	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013649/JAW	MF-414
215	14:37088	*See* LA-UR–89-965			
216	14:37035	*See* DOE/ER/40374–22			
217	14:37034	*See* DOE/ER/40374–21			
218	14:37049	*See* DOE/ER/40374–20			
219	14:37073	*See* DOE/ER/40374–19			
220	14:37048	*See* DOE/ER/40374–18			
221	14:37047	*See* DOE/ER/40374–17			
CONF-890397–		(New field measurements conference; Dallas, Texas, USA; 20 Mar 1989)			
2	14:37223	*See* PNL-SA–16782			
CONF-890403–		(7. international stellarator workshop; Oak Ridge, Tennessee, USA; 10-14 Apr 1989)			
25	14:37714	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014090/JAW	MF-420
26	14:37715	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014107/JAW	MF-420
CONF-890404–		(AAPG annual convention with DPA/EMD Divisions and SEPM; San Antonio, TX, USA; 23-26 Apr 1989)			
	14:35673				

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-890405–		(Fifty years with nuclear fission conference; Gaithersburg, MD, USA; 25-28 Apr 1989)			
23	14:37636	*See* UCRL–99847			
24	14:37605	*See* UCRL–101086			
CONF-8904107–		(2. international conference on high-density pinches (ICHDP-2); Laguna Beach, California, USA; 26-28 Apr 1989)			
4	14:37743	*See* SAND–89-0443C			
5	14:37736	*See* LA-UR–89-2144			
6	14:37735	*See* LA-UR–89-2088			
7	14:37737	*See* LA-UR–89-2188			
CONF-890415–		(Computing in high energy physics; Oxford, UK; 10-14 Apr 1989)			
5	14:37549	*See* FNAL/C–89/125-T			
6	14:37105	*See* DOE/ER/03130–44C			
7	14:37106	*See* DOE/ER/03130–45C			
CONF-8904153–		(Symposium on nuclear dynamics and nuclear disassembly; Dallas, Texas, USA; 9-14 Apr 1989)			
2	14:37599	*See* LBL–27116			
3	14:37597	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013536/JAW	MF-413
4	14:37596	*See* BNL–42803			
CONF-8904210–		(Cray user's group conference; Los Angeles, California, USA; 24-28 Apr 1989)			
6	14:37814	*See* UCRL–101034			
7	14:37815	*See* UCRL–101237			
CONF-8904224–		(Cosmic axion workshop; Upton, New York, USA; 13-14 Apr 1989)			
1	14:37517	*See* FNAL/C–89/104-A			
CONF-8904225–		(IAEA Technical Committee meeting on decontamination of transport casks and spent fuel storage facilities; Vienna, Austria; 4-7 Apr 1989)			
1	14:36888	*See* SAND–89-1312C			
CONF-8904226–		(12. international workshop on weak interactions and neutrinos; Ginosar, Israel; 9-14 Apr 1989)			
1	14:37535	*See* SLAC-PUB–4987			
2	14:37527	*See* LBL–27134			
3	14:37499	*See* DOE/ER/03130–46C			
CONF-8904227–		(Workshop on high luminosity asymmetric storage rings for AB-physics; Pasadena, California, USA; 25-28 Apr 1989)			
1	14:37064	*See* LBL–27189			
CONF-8904228–		(CERN accelerator school; Chester, UK; 6-13 Apr 1989)			
1	14:36964	*See* LBL–27034			
2	14:36965	*See* LBL–27035			
CONF-890423–		(CLEO '89: conference on lasers and electro optics; Baltimore, MD, USA; 24-28 Apr 1989)			
11	14:37782	*See* UCRL–101266			
CONF-8904230–		(AVS topical conference on surface conditioning of vacuum systems; Los Angeles, California, USA; 3-7 Apr 1989)			
1	14:37758	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012971/JAW	MF-422
2	14:37045	*See* SAND–89-0863C			
CONF-8904231–		(Constitutive relations and models in continuum theories of multiphase flows; Minneapolis, Minnesota, USA; 4-7 Apr 1989)			
1	14:37482	*See* SAND–88-3037C			
CONF-8904232–		(Pacific basin conference on hazardous waste; Singapore, China; 2-7 Apr 1989)			
1	14:35779	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013171/JAW	MF-402
CONF-8904233–		(Symposium on pion-nucleon and nucleon-nucleon physics; Leningrad, USSR; 22-27 Apr 1989)			
1	14:37510	*See* LA-UR–89-1751			
CONF-8904234–		(10. and final workshop on grand unification; Chapel Hill, North Carolina, USA; 20-22 Apr 1989)			
1	14:37511	*See* LA-UR–89-1871			
CONF-8904239–		(Small-Period Wiggler Designs workshop; Los Alamos, NM, USA; 13 Apr 1989)			
Summ.	14:36962	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014758/JAW	MF-422

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-890426–		(Spring meeting of the Materials Research Society; San Diego, California, USA; 24-28 Apr 1989)			
21	14:36615	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014642/JAW	MF-404
22	14:36647	*See* SAND–88-2865C			
23	14:36639	*See* LA-UR–89-1777			
CONF-890435–		(6. international conference on high temperatures: chemistry of inorganic materials; Gaithersburg, Maryland, USA; 3-7 Apr 1989)			
4	14:36662	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013646/JAW	MF-404
CONF-890468–		(16. international conference on metallurgical coatings and equipment exhibit; San Diego, California, USA; 17-21 Apr 1989)			
11	14:36472	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014643/JAW	MF-373
12	14:36844	*See* LA-UR–89-1883			
CONF-890491–		(International conference on fifty years of research in nuclear fission; Berlin, Germany, F.R.; 3-7 Apr 1989)			
	14:37602	*See* GSI–89-40(prepr.)			
CONF-8905107–		(SEM spring meeting; Cambridge, Massachusetts, USA; 28 May - 2 jun 1989)			
4	14:36586	*See* SAND–89-0815C			
CONF-8905120–		(8. topical conference on radio frequency power in plasmas; Irvine, CA, USA; 1-3 May 1989)			
18	14:37744	*See* UCLA/PPG–1237			
CONF-8905122–		(13. actinide separations conference; Idaho Falls, ID, USA; May 1989)			
7	14:35806	*See* PNL-SA–16743			
5-Vugraphs	14:35817	*See* WSRC-RP–89-87			
CONF-8905123–		(End use load information and application conference; Syracuse, NY, USA; 16-17 May 1989)			
2	14:36340	*See* PNL-SA–17006			
3	14:36393	*See* PNL-SA–16585			
CONF-8905143–		(NATO international advanced courses on the nuclear equation of state; Peniscola, Spain; 12 May - 3 jun 1989)			
2	14:37498	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014094/JAW	MF-413
CONF-8905146–		(22. Jerusalem symposium on quantum chemistry; Jerusalem, Israel; 15-18 May 1989)			
1	14:36735	*See* BNL–42831			
CONF-8905148–		(2. international workshop on real-time computing of the environmental consequences of an accidental release to the atmosphere from nuclear installations; Leuembourg, Netherlands; 16-19 May 1989)			
1	14:37164	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013639/JAW	MF-402
CONF-8905149–		(Digital Equipment Computer Users Society symposium; Atlanta, Georgia, USA; 8-12 May 1989)			
1	14:37809	*See* SAND–88-3041C			
CONF-8905150–		(NWW-CMM user group; Kansas City, MO, USA; 9-11 May 1989)			
1	14:37147	*See* UCRL–100969			
CONF-8905152–		(NIST and NRC workshop on cement solidification of low level radioactive waste; Gaithersburg, Maryland, USA; 31 May - 12 jun 1989)			
1	14:35818	*See* WSRC-RP–89-288			
CONF-8905153–		(WORMSHOP '89; Batavia, Illinois, USA; 11-13 May 1989)			
1	14:37708	*See* LA-UR–89-1745			
CONF-8905155–		(Radiation protection workshop; Chicago, IL, USA; 16-17 May 1989)			
1	14:35754	*See* FMPC–2174			
CONF-8905156–		(International Centre for Theoretical Physics conference; Trieste, Italy; 22-26 May 1989)			
1	14:37457	*See* LA-UR–89-1848			
CONF-8905157–		(Symposium on radiation hazards in space and biological consequences; Washington, DC, USA; 11 May 1989)			
1	14:37343	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013043/JAW	MF-408
CONF-8905158–		(IMOG maintenance subgroup; Denver, CO, USA; 17-18 May 1989)			
1	14:36998	*See* UCRL–101051			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8905161–		(International conference on surface and thin film studies using glancing-incidence x-ray and neutron scattering; Marseille, France; 31 May - 2 jun 1989)			
1	14:36854	*See* LBL–27046			
CONF-8905162–		(Hazardous waste and environmental management in gas industry; Chicago, IL, USA; 1-2 May 1989)			
1	14:37216	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013180/JAW	MF-000
CONF-8905163–		(3. conference on intersections between particle and nuclear physics; Rockport, ME, USA; 14-19 May 1989)			
1	14:37595	*See* LA-UR–89-1649			
CONF-8905164–		(Seminar at Paul Scherrer Institute; Wurenlingen, Switzerland; 29 May - 7 jun 1989)			
1	14:36362	*See* LBL–27082			
CONF-8905165–		(ANTEC '89; New York, NY, USA; 1-4 May 1989)			
1	14:36678	*See* MLM–3592(OP)			
CONF-8905166–		(American Society for Mass Spectroscopy annual symposium; Miami Beach, Florida, USA; 22-26 May 1989)			
1	14:36846	*See* PNL-SA–16621			
2	14:37143	*See* PNL-SA–16630			
3	14:37141	*See* PNL-SA–16622			
4	14:37142	*See* PNL-SA–16629			
5	14:37140	*See* MLM–3593(OP)			
6	14:37475	*See* PNL-SA–16839			
CONF-8905167–		(11. symposium on applied surface analysis; Cleveland, Ohio, USA; 31 May - 2 jun 1989)			
1	14:37688	*See* MLM–3951(OP)			
CONF-8905168–		(44. annual STLE meeting; Atlanta, Georgia, USA; 1-4 May 1989)			
1	14:36478	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014635/JAW	MF-373
CONF-890517–		(10. symposium on microdosimetry; Rome, Italy; 21-26 May 1989)			
4	14:37663	*See* PNL-SA–16298			
CONF-8905175–		(International lead-acid zinc research seminar; Orlando, FL, USA; 4-5 May 1989)			
1	14:36221	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012429/JAW	MF-000
CONF-8905179–		(8. Pfefferkorn conference on fundamental beam interactions with solids for microscopy, microanalysis and microlithography; Park City, UT, USA; 7-12 May 1989)			
2	14:36726	*See* LBL–27166			
CONF-890533–		(9. SERI photovoltaic advanced research and development project review meeting; Lakewood, CO, USA; 24-26 May 1989)			
Absts.	14:35908	*See* SERI/CP–213-3495			
CONF-890541–		(Evolution of advanced materials; Milan, Italy; 31 May - 2 jun 1989)			
1	14:36473	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013046/JAW	MF-404
CONF-890545–		(6. conference on real-time computer applications in nuclear, particle and plasma physics; Williamsburg, Virginia, USA; 15-18 May 1989)			
4	14:37153	*See* UCRL–101058			
5	14:37761	*See* GA-A–19684			
CONF-890546–		(Seminar on fission product transport processes in reactor accidents; Dubrovnik, Yugoslavia; 22-26 May 1989)			
7	14:36110	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012972/JAW	MF-000
CONF-890565–		(11. annual ESARDA symposium on safeguards and nuclear materials management; , Luxembourg; 30 May - 1 jun 1989)			
7	14:35836	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013286/JAW	MF-515
CONF-890582–		(Biological processing of coal and coal-derived substances; Palo Alto, CA, USA; 16-17 May 1989)			
1	14:35519	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011577/JAW	MF-108
CONF-890594–		(3. advanced inertial confinement fusion accelerator beam dynamics workshop: beam-beam effects in circular colliders; Novosibirsk, USSR; 20 May - 3 jun 1989)			
1	14:37050	*See* DOE/ER/40374–23			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-890601–		(Packaging and transportation of radioactive materials: PATRAM '89; Arlington, VA, USA; 11-16 Jun 1989)			
1	14:35777	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014080/JAW	MF-513
CONF-890604–		(Annual meeting of the American Nuclear Society; Atlanta, Georgia, USA; 4-8 Jun 1989)			
5	14:36036	*See* WHC-SA–0455			
6	14:35759	*See* WHC-SA–0471			
7	14:36037	*See* WHC-SA–0498			
12	14:36977	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013282/JAW	MF-506
CONF-890609–		(ASHRAE annual meeting; Vancouver, Canada; 24-28 Jun 1989)			
2	14:36386	*See* LBL–26816			
5	14:36375	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013047/JAW	MF-350
CONF-8906112–		(7. symposium on energy engineering sciences; Argonne, Illinois, USA; 19-21 Jun 1989)			
1	14:37799	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014069/JAW	MF-705
CONF-8906131–		(2. international symposium on multiphase flow and heat transfer; Xian, China; 22-24 Jun 1989)			
1	14:36979	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012418/JAW	MF-000
CONF-8906132–		(Automatic RF Technologies Group meeting; Long Beach, CA, USA; 15 Jun 1989)			
1	14:37146	*See* SAND–89-1192C			
CONF-8906133–		(15. transducer workshop; Cocoa Beach, FL, USA; 20-22 Jun 1989)			
1	14:37001	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013050/JAW	MF-000
2	14:37135	*See* EGG–10617-1033			
3	14:36891	*See* SAND–89-1594C			
CONF-8906134–		(24. thermophysics conference; Buffalo, NY, USA; 12-15 Jun 1989)			
1	14:36409	*See* SAND–88-3334C			
CONF-8906135–		(International congress on technology and technology exchange; New York, NY, USA; 28 Jun 1989)			
1	14:36479	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013029/JAW	MF-704
CONF-8906136–		(Machine tool subgroup spring meeting; Pinnellas, FL, USA; 6-8 Jun 1989)			
1	14:36587	*See* UCRL–101189			
CONF-8906137–		(Joint NEA/CEC workshop on technical aspects of emergency planning; Brussels, Belgium; 27-29 Jun 1989)			
1	14:37344	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013006/JAW	MF-000
CONF-8906138–		(International symposium on the design of water quality information systems; Fort Collins, Colorado, USA; 7-9 Jun 1989)			
1	14:37255	*See* DP-MS–88-185			
CONF-8906139–		(31. weapons agencies nondestructive testing organization; Kansas City, MO, USA; 5-9 Jun 1989)			
1	14:36997	*See* SAND–89-1406C			
CONF-8906140–		(Health Physics Society summer school; Santa Fe, NM, USA; 19-23 Jun 1989)			
1	14:37345	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013704/JAW	MF-407
CONF-8906141–		(Computer security risk management model builders workshop; Ottawa, Canada; 20-22 Jun 1989)			
1	14:35838	*See* LA-UR–89-1558			
CONF-8906142–		(International hot dry rock (HDR) geothermal energy conference; Camborne, UK; 27-30 Jun 1989)			
1	14:35941	*See* LA-UR–89-1878			
2	14:35942	*See* LA-UR–89-2129			
CONF-8906143–		(Western states forging conference; Carbondale, CO, USA; 5-7 Jun 1989)			
1	14:37023	*See* SAND–89-1385C			
CONF-8906144–		(Conference on free and responsible individual vs. prior restraint; Bozeman, Montana, USA; 8-11 Jun 1989)			
1	14:37401	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013709/JAW	MF-400
CONF-8906146–		(21. Latin American conference on rural electrification; Guatemala City, Guatemala; 5-6 Jun 1989)			
1	14:36274	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013550/JAW	MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8906147–		(International congress on technology and technology exchange; New York, NY, USA; 28-30 Jun 1989)			
1	14:36617	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013551/JAW	MF-332
CONF-8906148–		(Fusion Power Associates annual meeting; Washington, DC, USA; 1-2 Jun 1989)			
1	14:37716	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013540/JAW	MF-420
2	14:37779	*See* SAND–89-1495C			
CONF-8906150–		(3. international conference on microcomputers in transportation; San Francisco, California, USA; 21-23 Jun 1989)			
1	14:37800	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013542/JAW	MF-400
CONF-8906155–		(Radiation effects in insulators-5: crystalline oxides and ceramics session; Hamilton, Canada; 19-23 Jun 1989)			
1	14:36618	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014797/JAW	MF-404
CONF-8906161–		(Ion beam analysis conference; Kingston, Canada; 26-30 Jun 1989)			
2	14:37777	*See* SAND–89-0894C			
CONF-890618–		(9. international conference on laser spectroscopy; Bretton Woods, NH, USA; 18-23 Jun 1989)			
1	14:37139	*See* LA-UR–89-2148			
2	14:37464	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014098/JAW	MF-411
CONF-890619–		(34. annual meeting of the Health Physics Society; Albuquerque, New Mexico, USA; 25-29 Jun 1989)			
3	14:37133	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014761/JAW	MF-000
CONF-890627–		(19. biennial conference on carbon; University Park, Pennsylvania, USA; 25-30 Jun 1989)			
2	14:36663	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014086/JAW	MF-404
CONF-890631–		(International symposium on packaging and transporting of radioactive materials; Washington, DC, USA; 11-16 Jun 1989)			
53	14:36887	*See* SAND–89-1212C			
54	14:36871	*See* GA-A–19416			
CONF-890652–		(6. Rochester conference on coherence and quantum optics; Rochester, NY, USA; 26-28 Jun 1989)			
1	14:37465	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014076/JAW	MF-401
CONF-890659–		(14. annual meeting and international symposium of the Technology Transfer Society; Oak Ridge, Tennessee, USA; 13-16 Jun 1989)			
1	14:36241	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014770/JAW	MF-400
2	14:36242	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014766/JAW	MF-400
CONF-890665–		(7. Institute of Electrical and Electronics Engineers pulsed power conference; Monterey, California, USA; 12-14 Jun 1989)			
18	14:37773	*See* SAND–88-3437C			
19	14:36882	*See* SAND–88-3169C			
20	14:37774	*See* SAND–89-0007C			
22	14:37016	*See* SAND–89-0068C			
23	14:37483	*See* SAND–89-0025C			
25	14:37092	*See* SAND–88-3360C			
26	14:37046	*See* UCRL–100356			
27	14:37006	*See* LA-UR–89-1990			
28	14:37686	*See* LA-UR–89-1967			
29	14:37005	*See* LA-UR–89-1941			
30	14:36963	*See* LA-UR–89-1932			
31	14:37771	*See* LA-UR–1909			
32	14:37004	*See* LA-UR–89-1911			
33	14:37003	*See* LA-UR–89-1905			
34	14:37019	*See* UCRL–100361			
CONF-890673–		(IWGFR specialists meeting on advanced controls for fast reactors; Argonne, IL, USA; 20-22 Jun 1989)			
1	14:36094	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014764/JAW	MF-530
2	14:36027	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014776/JAW	MF-530
CONF-890674–		(7. international conference on Fourier transform spectroscopy; Fairfax, Virginia, USA; 19-23 Jun 1989)			
1	14:37300	*See* SAND–89-1145C			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
3	14:37138	*See* LA-UR–89-1951			
CONF-890692–		(82. Air and Waste Management Association annual meeting and exhibition; Anaheim, California, USA; 25-30 Jun 1989)			
13-Rev.1	14:37196	*See* UCRL–99927-Rev.1			
CONF-890702–		(28. international geological congress; Washington, DC, USA; 9-19 Jul 1989)			
2	14:37413	*See* SAND–89-1366C			
3	14:37410	*See* LA-UR–89-1928			
CONF-890703–		(International conference on ion sources; Berkeley, California, USA; 9-15 Jul 1989)			
2	14:37778	*See* SAND–89-1390C			
4	14:37776	*See* SAND–89-0354C			
8	14:37775	*See* SAND–89-0275C			
9	14:37089	*See* LA-UR–89-2071			
10	14:37466	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014096/JAW	MF-413
12	14:37467	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014875/JAW	MF-414
CONF-890710–		(5. international conference on megagauss magnetic field generation and related topics; Novosibirsk, USSR; 3-7 Jul 1989)			
1	14:37742	*See* SAND–88-3311C			
2	14:37012	*See* LA-UR–89-2169			
3	14:37481	*See* LA-UR–89-2187			
4	14:37011	*See* LA-UR–89-2163			
5	14:37008	*See* LA-UR–89-2097			
6	14:37009	*See* LA-UR–89-2106			
7	14:37013	*See* LA-UR–89-2194			
8	14:37806	*See* LA-UR–89-2087			
9	14:37734	*See* LA-UR–89-2085			
10	14:37090	*See* LA-UR–89-2080			
11	14:36878	*See* LA-UR–89-2138			
12	14:37010	*See* LA-UR–89-2137			
13	14:37480	*See* LA-UR–89-2165			
14	14:37473	*See* LA-UR–89-2164			
15	14:37007	*See* LA-UR–89-1992			
CONF-890711–		(5. international conference on emerging nuclear energy systems: ICENES '89; Karlsruhe, Germany, F.R.; 3-6 Jul 1989)			
1	14:37770	*See* LA-UR–89-2205			
CONF-890717–		(European wind energy conference and exhibition; Glasgow, UK; 10-13 Jul 1989)			
1	14:36881	*See* SAND–88-3057C			
2	14:35952	*See* SERI/TP–217-3505			
CONF-890718–		(International conference on materials and mechanisms of superconductivity - high-temperature superconductors; Stanford, California, USA; 23-28 Jul 1989)			
1	14:37698	*See* SAND–89-1496C			
2	14:37476	*See* SAND–89-1546C			
3	14:36641	*See* LA-UR–89-2141			
4	14:36642	*See* LA-UR–89-2142			
5	14:36640	*See* LA-UR–89-2059			
6	14:36584	*See* SAND–89-0506C			
CONF-890721–		(Joint ASME/JSME pressure vessel and piping conference; Honolulu, Hawaii, USA; 23-27 Jul 1989)			
1	14:36884	*See* SAND–88-8934			
10-Rev.1	14:36126	*See* DP-MS–88-143-Rev.1			
11	14:36082	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008735/JAW	MF-000
12	14:36083	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008242/JAW	MF-504
13	14:36035	*See* WHC-SA–0412			
14	14:36869	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008921/JAW	MF-71
15	14:36084	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008745/JAW	MF-520
16	14:35989	*See* EGG-M–88303			
17	14:36114	*See* EGG-M–88332			
18	14:36894	*See* UCRL–100757			
19	14:36014	*See* UCRL–100788			
20	14:36995	*See* SAND–89-0343C			
21	14:35778	NTIS, PC A02/MF A01 - OSTI		DE89010171/JAW	MF-70
22	14:36474	NTIS, PC A02/MF A01 - OSTI		DE89010179/JAW	MF-000
23	14:36006	NTIS, PC A02/MF A01 - OSTI		DE89010258/JAW	MF-000
24	14:36475	NTIS, PC A02/MF A01 - OSTI		DE89010324/JAW	MF-504

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-890721–					
25	14:36984	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010840/JAW	MF-406
26	14:36885	*See* SAND–88-8935			
27	14:35990	*See* EGG-M–88448			
28	14:36144	*See* EGG-M–88406			
29	14:36085	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012428/JAW	MF-000
30	14:36588	*See* WHC-SA–0536			
31	14:36142	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013306/JAW	MF-520
32	14:36143	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013191/JAW	MF-000
35	14:36129	*See* BNL-NUREG–42727			
CONF-890723–		(26. annual conference on nuclear and space radiation effects; Marco Island, Florida, USA; 24-28 Jul 1989)			
5	14:37130	*See* SAND–89-0334C			
6	14:37002	*See* LA-UR–89-489			
8	14:37017	*See* SAND–89-0292C			
CONF-890735–		(30. annual meeting of the Institute of Nuclear Materials Management; Orlando, Florida, USA; 9-12 Jul 1989)			
2	14:35745	*See* WHC-SA–0581			
6	14:37812	*See* SAND–89-1575C			
7	14:36886	*See* SAND–89-1113C			
8	14:35849	*See* SAND–89-1604C			
10	14:35850	*See* SAND–89-1605C			
11	14:35847	*See* SAND–89-1601C			
12	14:35848	*See* SAND–89-1603C			
13	14:35843	*See* RFP–4296			
14	14:35844	*See* RFP–4307			
15	14:37791	*See* SAND–89-1109C			
16	14:37018	*See* SAND–89-1569C			
17	14:37789	*See* SAND–89-1029C			
18	14:37790	*See* SAND–89-1108C			
19	14:35846	*See* SAND–89-1111C			
20	14:36890	*See* SAND–89-1587C			
21	14:35845	*See* SAND–89-1110C			
22	14:37792	*See* SAND–89-1609C			
23	14:35756	*See* LA-UR–89-2151			
24	14:35757	*See* LA-UR–89-2152			
25	14:36892	*See* SAND–89-1616C			
26	14:37807	*See* LA-UR–89-2130			
27	14:35790	*See* LA-UR–89-2066			
28	14:36397	*See* SAND–89-1595C			
29	14:35840	*See* LA-UR–89-2047			
30	14:35839	*See* LA-UR–89-2031			
31	14:35851	*See* SAND–89-1645C			
CONF-890737–		(ASME fluids engineering meeting; San Diego, California, USA; 9-12 Jul 1989)			
2	14:37145	*See* SAND–89-0133C			
CONF-890741–		(ASME international computers in engineering conference; Anaheim, California, USA; 30 Jul - 2 aug 1989)			
1	14:37810	*See* SAND–88-3089C			
CONF-890744–		(VLSI education conference and exposition; Santa Clara, California, USA; 19-21 Jul 1989)			
1	14:37000	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89007516/JAW	MF-000
2	14:37798	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89007515/JAW	MF-405
CONF-890746–		(4. international conference on modulated semiconductor structures; Ann Arbor, MI, USA; 17-21 Jul 1989)			
1	14:37689	*See* SAND–89-0542C			
CONF-890752–		(6. international conference on numerical methods in laminar and turbulent flows; Swansea, UK; 11-15 Jul 1989)			
1	14:37484	*See* SAND–89-0046C			
2	14:37485	*See* SAND–89-0780C			
CONF-890753–		(Summer computer simulation conference; Austin, Texas, USA; 24-27 Jul 1989)			
1	14:35763	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009114/JAW	MF-526
CONF-890754–		(6. international topical meeting on photoacoustic and photothermal phenomena; Baltimore, Maryland, USA; 31 Jul - 3 aug 1989)			
1	14:36616	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009643/JAW	MF-404

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-890768–		(International geoscience and remote sensing symposium; Vancouver, Canada; 10-14 Jul 1989)			
1	14:37404	*See* DOE/ER/13796–3			
CONF-890769–		(3. international symposium on analysis and detection of explosives; Mannheim, Germany, F.R.; 10-13 Jul 1989)			
2	14:37148	NTIS, PC A03/MF A01 - OSTI		DE89012510/JAW	MF-706
3	14:37149	*See* SAND–89-0677C			
CONF-890771–		(American Crystallographic Association annual meeting; Seattle, Washington, USA; 23-29 Jul 1989)			
1	14:36664	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011230/JAW	MF-404
2	14:37685	*See* LA-UR–89-1462			
CONF-890772–		(Plasticity '89: international symposium on plasticity; Ton, Japan; 31 Jul - 4 aug 1989)			
1	14:36572	*See* LA-UR–89-1241			
2	14:36573	*See* LA-UR–89-1423			
CONF-890779–		(International symposium on symbolic and algebraic computing; Portland, Oregon, USA; 17-19 Jul 1989)			
1	14:37813	*See* UCRL–100959			
CONF-890780–		(9. international system safety conference; Long Beach, California, USA; 17-20 Jul 1989)			
1	14:36158	*See* LA-UR–89-1178			
CONF-890785–		(Drag reduction international conference: additives and passive devices; Davos, Switzerland; 31 Jul - 3 aug 1989)			
1	14:36422	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013275/JAW	MF-350
CONF-890789–		(3. international symposium on acoustic emission from reinforced composites; Paris, France; 17-21 Jul 1989)			
1	14:36994	*See* RFP–4297			
CONF-890790–		(5. world conference on transport research; Yokohama, Japan; 10-14 Jul 1989)			
2	14:36401	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013301/JAW	MF-330
CONF-890791–		(NSF workshop on future directions in electromagnetics research; Boston, MA, USA; 25-27 Jul 1989)			
1	14:37690	*See* SAND–89-1346C			
CONF-890792–		(Worldwide catalysis seminar: successful design of catalysts; Philadelphia, PA, USA; 5 Jul 1989)			
1	14:36736	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013310/JAW	MF-401
CONF-890793–		(International conference on dynamic travel behavior analysis; Kyoto, Japan; 18-19 Jul 1989)			
1	14:36402	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013024/JAW	MF-400
CONF-890794–		(3. American Society of Civil Engineers/American Society of Mechanical Engineers mechanics conference; San Diego, CA, USA; 9-12 Jul 1989)			
1	14:36978	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013426/JAW	MF-406
CONF-890796–		(International workshop on high power opening switches; Novosibirsk, USSR; 1-2 Jul 1989)			
1	14:37780	*See* SAND–89-1522C			
COO–					
3130TC-41	14:37103	*See* DOE/ER/03130–41C			
3130TC-50	14:37500	*See* DOE/ER/03130–50C			
CRL–					
87-123(OP,TR)	14:35548	CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1			ND-000
87-134(TR)	14:35561	CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1			ND-000
88-23(OP,J)	14:35549	CANMET, 555 Booth St, Ottawa, Canada, K1A OG1			ND-000
88-26(TR)	14:35567				ND-000
88-34(TR)	14:35568	CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1			ND-000
88-36(TR)	14:35569	CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1			ND-000
88-41(TR)	14:35570	CANMET, 555 Booth St, Ottawa, Canada, K1A OG1			ND-000
88-45(TR)	14:35571	CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1			ND-000
88-48-(TR)	14:35572				ND-000
88-49(J,TR)	14:35573	CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1			ND-000
88-55(TR)	14:35550	CANMET, 555 Booth St, Ottawa, Canada, K1A OG1			ND-000
88-57(IR)	14:35574	CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1			ND-000
CRN-HE–					
85-06	14:37547	NTIS (US Sales Only), PC A09/MF A01		DE89789234/JAW	MF-000
87-08	14:37101	NTIS (US Sales Only), PC A04/MF A01		DE89789271/JAW	MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CRN-PN–					
8513	14:37587	NTIS (US Sales Only), PC A03/MF A01		DE89789226/JAW	MF-000
8620	14:37580	NTIS (US Sales Only), PC A06/MF A01		DE89776429/JAW	MF-000
88-02	14:37586	NTIS (US Sales Only), PC A03/MF A01		DE89789273/JAW	MF-000
8811	14:37576	NTIS (US Sales Only), PC A02/MF A01		DE89789272/JAW	MF-000
CRN-VIV–					
60	14:37071	NTIS (US Sales Only), PC A03/MF A01		DE89789270/JAW	MF-000
CRSL–					
ESRF087	14:37282	Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, ON, Canada K1A 0E4; $18.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
CSIR-CENG–					
654	14:35859	*See* PB–89-167217/XAB			
655	14:35543	*See* PB–89-167209/XAB			
CSIR-RR–					
487	14:36405	*See* PB–89-163976/XAB			
488	14:36406	*See* PB–89-163984/XAB			
CSIR-SR-ATMOS–					
87/13	14:37187	*See* PB–89-167654/XAB			
CTA-EAv-CPD-SC–					
019/81	14:36068	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89620446/JAW	MF-000
CTA-EAv-FTE–					
022/81	14:37801	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89620447/JAW	MF-000
CTP-TAMU–					
76/8	14:37700	*See* IC–88/398			
CU/FCE–					
8903	14:35691	Faculty of Continuing Education, University of Calgary, 2500 University Drive, N.W., Calgary, AB, Canada T2N 1N4; $30.00 CAN.			ND-000
CUED/D-SOILS/TR–					
220	14:37222	*See* PB–89-167365/XAB			
DA-TM–					
5-814-8	14:37281	*See* PB–89-175459/XAB			
DCN–					
88-218-043-45	14:35675	*See* PB–89-173595/XAB			
DEA–					
1989	14:36228	Canada Dept. of External Affairs, Lester B. Pearson Bldg., 125 Sussex Dr., Ottawa, ON, Canada K1A 0G2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
DFTT–					
19/88	14:37516	*See* CBPF-NF–054/88			
DFVLR-FB–					
89-06	14:37160	NTIS (US Sales Only), PC A09/MF A01		DE89788359/JAW	MF-000
DND/RDB–					
1/88	14:36666	Canada Dept. of National Defence, 101 Colonel By Dr., 2NT, National Defence Headquarters, Ottawa, ON, Canada K1A 0K2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
DOE/BC/14204–					
2	14:35632	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014217/JAW	MF-122
DOE/BC/14425–					
1	14:35600	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014843/JAW	MF-122
DOE/CE–					
0263	14:36376	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013871/JAW	MF-350
DOE/CE/15270–					
T10	14:35901	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014452/JAW	MF-242
DOE/CE/15289–					
T1	14:35929	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008587/JAW	MF-231
DOE/CE/15316–					
T3	14:36870	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009115/JAW	MF-310
DOE/CE/26561–					
T2	14:36424	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012748/JAW	MF-350
DOE/CH/10093–					
46	14:35925	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000861/JAW	MF-234

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/EH/79050–					
T1	14:37150	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014554/JAW	MF-603
DOE/EIA–					
0035(89/03)	14:35648	NTIS, PC A08/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE89014154/JAW	MF-950
0109(89/03)	14:35649	NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE89012962/JAW	MF-950
0109(89/04)	14:35650	NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE89014156/JAW	MF-950
0130(89/04)	14:35674	NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE89014078/JAW	MF-950
0340(88)/1	14:35651	NTIS, PC A08/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE89014826/JAW	MF-950
0517(89)	14:35652	NTIS, PC A06/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE89013169/JAW	MF-950
0520(89/06)	14:35653	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014810/JAW	MF-950
0523(89/1Q)	14:35601	NTIS, PC A03/MF A01 - GPO - OSTI		DE89014438/JAW	MF-950
0527(89)	14:36256	NTIS, PC A04/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE89014111/JAW	MF-950
M033(87)	14:36341	NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE89014433/JAW	MF-950
M037	14:35640	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012629/JAW	MF-950
DOE/EIS–					
0146D	14:35565	NTIS, PC A13/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013883/JAW	PC-101
DOE/ER–					
0313/5	14:37759	NTIS, PC A15/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013734/JAW	PC-423;STD-424
DOE/ER/00881–					
T1	14:37491	NTIS, PC A18/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014506/JAW	MF-414
DOE/ER/03130–					
3	14:37492	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013952/JAW	MF-414
5	14:37102	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013931/JAW	MF-414
267	14:37501	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013950/JAW	MF-414
41C	14:37103	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013961/JAW	MF-413
425	14:37493	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013963/JAW	MF-414
43C	14:37104	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013954/JAW	MF-414
44C	14:37105	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013955/JAW	MF-414
45C	14:37106	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013956/JAW	MF-414
46C	14:37499	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013957/JAW	MF-413
48C	14:37028	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013958/JAW	MF-405
50C	14:37500	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013962/JAW	MF-414
DOE/ER/03230–					
T8	14:37494	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014534/JAW	MF-414
DOE/ER/13278–					
2	14:37324	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013968/JAW	MF-401
DOE/ER/13281–					
5	14:36707	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013942/JAW	MF-401
DOE/ER/13339–					
5	14:37325	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011526/JAW	MF-408
DOE/ER/13411–					
4	14:36737	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014683/JAW	MF-401
DOE/ER/13544–					
T2	14:36868	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014498/JAW	MF-401
DOE/ER/13564–					
7	14:36738	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013965/JAW	MF-401
DOE/ER/13576–					
3	14:37134	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014165/JAW	MF-406
DOE/ER/13582–					
T2	14:36739	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014535/JAW	MF-401
DOE/ER/13584–					
4	14:36740	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014682/JAW	MF-401
DOE/ER/13603–					
T1	14:36741	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014694/JAW	MF-401
DOE/ER/13796–					
3	14:37404	NTIS, PC A02/MF A01 - OSTI		DE89010877/JAW	MF-403
DOE/ER/25026–					
31	14:37802	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014169/JAW	MF-405
DOE/ER/40002–					
T1	14:37563	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012698/JAW	MF-413
DOE/ER/40004–					
T2	14:37564	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014557/JAW	MF-414
T4	14:37565	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014562/JAW	MF-414
DOE/ER/40124–					
17	14:37072	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014120/JAW	MF-414
DOE/ER/40150–					
73	14:37566	NTIS, PC A17/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014427/JAW	MF-414
74	14:37502	NTIS, PC A14/MF A01 - OSTI		DE89014431/JAW	MF-414
75	14:37567	NTIS, PC A21/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014430/JAW	MF-414

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
78	14:37568	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014426/JAW	MF-414
79	14:37031	NTIS, PC A23/MF A01 - OSTI (37.00); GPO Dep.	E 1.99:	DE89014424/JAW	MF-414
80	14:37032	NTIS, PC A99/MF A01 - OSTI (47.50)		DE89014428/JAW	MF-414
81	14:37569	NTIS, PC A99/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014423/JAW	MF-410
82	14:37107	NTIS, PC A21/MF A01 - OSTI		DE89014429/JAW	MF-414
DOE/ER/40253–					
148	14:37495	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014168/JAW	MF-414
DOE/ER/40315–					
156	14:37503	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014470/JAW	MF-414
157	14:37108	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014471/JAW	MF-410
158	14:37504	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014472/JAW	MF-414
159	14:37505	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014473/JAW	MF-414
160	14:37496	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014474/JAW	MF-413
DOE/ER/40323–					
T1	14:37570	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014123/JAW	MF-414
T2	14:37506	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014124/JAW	MF-414
DOE/ER/40355–					
T1	14:37033	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014528/JAW	MF-414
DOE/ER/40372–					
T1	14:37109	NTIS, PC A02/MF A01 - OSTI		DE89013678/JAW	MF-414
DOE/ER/40374–					
17	14:37047	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013943/JAW	MF-414
18	14:37048	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013944/JAW	MF-414
19	14:37073	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013945/JAW	MF-414
20	14:37049	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013946/JAW	MF-414
21	14:37034	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013947/JAW	MF-414
22	14:37035	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013948/JAW	MF-414
23	14:37050	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013949/JAW	MF-414
DOE/ER/40481–					
2	14:37583	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014563/JAW	MF-412
DOE/ER/45085–					
T1	14:36480	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014537/JAW	MF-401
DOE/ER/45131–					
7	14:37664	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014527/JAW	MF-410
DOE/ER/45147–					
4	14:36481	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013964/JAW	MF-404
DOE/ER/45186–					
T1	14:36482	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014530/JAW	MF-404
DOE/ER/45254–					
3	14:36667	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014860/JAW	MF-404
DOE/ER/45262–					
T1	14:36483	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013803/JAW	MF-404
DOE/ER/60290–					
T2	14:37165	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014532/JAW	MF-402
DOE/ER/60399–					
T2	14:37206	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014536/JAW	MF-408
DOE/ER/60556–					
T1	14:37326	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014435/JAW	MF-401
DOE/ER/60623–					
1	14:37298	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013967/JAW	MF-408
DOE/ER/72027–					
T2	14:36742	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014113/JAW	MF-401
DOE/ET/15601–					
30	14:36345	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013110/JAW	MF-112
DOE/FC/10618–					
T1	14:37217	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010850/JAW	MF-107
DOE/FE–					
0132	14:35522	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013913/JAW	MF-109
0133	14:35692	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013912/JAW	MF-123
0134	14:35667	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013911/JAW	MF-132
0135	14:35633	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013909/JAW	MF-122
DOE/FE/60457–					
H4	14:35523	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013882/JAW	PC-101;STD-108
DOE/ID–					
10204-2	14:36412	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014157/JAW	MF-310
DOE/ID/12549–					
1	14:35938	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014219/JAW	MF-225
DOE/IG–					
0008/10-7	14:36269	OSTI		TI89014585/JAW	PC-960

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/IR/05106–					
T52	14:36253	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014845/JAW	MF-350
T53	14:36425	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014909/JAW	MF-350
T54	14:36197	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014913/JAW	MF-202
T59	14:36426	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013823/JAW	MF-350
T60	14:36427	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013824/JAW	MF-350
T63	14:36403	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013828/JAW	MF-335
T67	14:36428	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013831/JAW	MF-249
T68	14:36377	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013832/JAW	MF-350
T76	14:36429	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013840/JAW	MF-350
T78	14:36361	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013842/JAW	MF-350
T81	14:36254	NTIS, PC A04/MF A01 - OSTI		DE89013845/JAW	MF-350
T89	14:36430	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013854/JAW	MF-249
DOE/MC/23077–					
2696	14:35524	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012443/JAW	MF-109
DOE/MC/23253–					
2679	14:35581	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000970/JAW	PC-111;STD-111
DOE/MC/24219–					
2705	14:35670	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000992/JAW	MF-132
DOE/NASA–					
4105-4	14:36448	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014584/JAW	PC-336
DOE/NV/10384–					
26	14:35780	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014524/JAW	MF-702
DOE/OR/21390–					
T25	14:35902	NTIS, PC A99/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014798/JAW	MF-241
DOE/OR/21400–					
T371	14:37227	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010175/JAW	MF-400
DOE/OR/21697–					
1	14:36378	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014125/JAW	MF-400
DOE/PC/60419–					
T10	14:35582	NTIS, PC A20/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008271/JAW	MF-104
DOE/PC/79808–					
T2	14:35525	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014725/JAW	MF-108
DOE/PC/79856–					
T1	14:35957	NTIS, PC A03/MF A01 - OSTI		DE89011416/JAW	PC-105;STD-105
DOE/PC/79905–					
T7	14:35551	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013104/JAW	MF-102
DOE/PC/79907–					
T5	14:35552	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013684/JAW	MF-102
DOE/PC/79909–					
6	14:35583	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013083/JAW	MF-104
DOE/PC/79914–					
T5	14:35553	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013100/JAW	MF-113
DOE/PC/81012–					
T1-Pt.1-A	14:35958	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012483/JAW	PC-105;STD-105
DOE/PC/88801–					
T2	14:35526	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013676/JAW	MF-108
DOE/PC/88802–					
T1	14:35527	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014659/JAW	MF-108
DOE/PC/88827–					
T2	14:35643	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013516/JAW	MF-125
DOE/PC/88875–					
T1	14:35511	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014662/JAW	MF-102
T2	14:35512	NTIS, PC A16/MF A01 - OSTI		DE89014664/JAW	MF-102
DOE/PC/88886–					
T2	14:35513	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013514/JAW	MF-102
DOE/PC/88900–					
4	14:35584	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014559/JAW	MF-113
DOE/PC/88910–					
T1	14:35585	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014503/JAW	MF-107
DOE/PC/88920–					
T1	14:35528	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013103/JAW	MF-102
DOE/PC/88922–					
T1	14:35529	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014214/JAW	MF-102

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/PC/88925–					
T1	14:35554	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014504/JAW	MF-113
DOE/PC/90274–					
T1	14:36346	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014126/JAW	MF-112
T2	14:36347	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014130/JAW	MF-112
T3	14:36348	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014129/JAW	MF-112
DOE/PC/90502–					
11	14:35555	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014117/JAW	MF-102
DOE/PC/90504–					
T10	14:35556	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013782/JAW	MF-102
DOE/PC/90507–					
T11	14:35557	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014166/JAW	MF-102
DOE/PC/90508–					
T8	14:35558	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011390/JAW	PC-108;STD-108
DOE/PC/90521–					
T10	14:35559	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014727/JAW	MF-113
DOE/PC/90523–					
T4	14:35530	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014505/JAW	MF-108
DOE/PC/90753–					
T12	14:35586	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014116/JAW	MF-104
DOE/PC/90908–					
T6	14:35531	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013505/JAW	MF-108
DOE/PC/90956–					
T8	14:35577	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014437/JAW	MF-115
DOE/PC/90958–					
T8	14:35578	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013683/JAW	MF-114
DOE/PC/91271–					
T22	14:35514	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009795/JAW	PC-102;STD-102
DOE/PE/70411–					
T2	14:37803	NTIS, PC A04/MF A01 - OSTI		DE89014518/JAW	MF-920
DOE/PETC/TR–					
89/6	14:35560	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013627/JAW	PC-108
DOE/RA/50153–					
3	14:35969	NTIS, PC A15/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014786/JAW	MF-221
DOE/RL/01830–					
H3	14:35654	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014614/JAW	PC-513;STD-920
DOE/RW–					
0225	14:35782	OSTI		TI89014824/JAW	MF-810
0235	14:35783	OSTI		TI89014825/JAW	MF-810
88.061	14:35781	NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS		DE89620341/JAW	MF-000
DOE/SF/16306–					
15	14:35927	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014525/JAW	MF-231
DOE/SF/17714–					
T1	14:36379	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014122/JAW	MF-350
DOE/SSDP–					
0062	14:35784	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014216/JAW	MF-511
DOT/FAA/PP–					
89-2	14:37398	*See* AD-A–204724/9/XAB			
DP-MS–					
88-143-Rev.1	14:36126	NTIS, PC A03/MF A01 - OSTI		DE89008305/JAW	MF-520
88-185	14:37255	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013710/JAW	MF-702
EC–					
1988	14:36235	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
EC/IWD–					
7	14:37256	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
157	14:37257	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
1988	14:35873	Water Survey of Canada, Place Vincent Massey, 351 St. Joseph Blvd., Ottawa, ON, Canada K1A 0E7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
IW/L-AR-WQB-88-143	14:37219	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
EC/NHR/S–					
88016	14:37234	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
EC/WTC–					
1989	14:35857	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
ECN–					
89-045	14:36431	Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands			ND-000
ECTB–					
171-12A	14:37179	*See* PB–89-164651/XAB			
EGG–					
10617-1033	14:37135	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014039/JAW	MF-706
10617-2015	14:37207	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013926/JAW	MF-600
EGG-M–					
88303	14:35989	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009646/JAW	MF-000
88332	14:36114	NTIS, PC A02/MF A01 - OSTI		DE89009734/JAW	MF-520
88406	14:36144	NTIS, PC A02/MF A01 - OSTI		DE89011131/JAW	MF-000
88448	14:35990	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010980/JAW	MF-000
EMR–					
M91-7/30-1988E	14:35953	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
EPA–					
450/2-89/003	14:37192	*See* PB–89-172274/XAB			
520/5-88-016	14:37278	OSTI - US Environmental Protection Agency, Office of Radiation Programs, 401 M. Street SW, Washington DC 20460		TI89014442/JAW	MF-000
520/5-88-019	14:37279	OSTI - US Environmental Protection Agency, Office of Radiation Programs, 401 M Street SW, Washington, DC 20460		TI89014544/JAW	MF-000
600/3-89/006	14:37189	*See* PB–89-169833/XAB			
EPRI-CU–					
6376	14:36413	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6400	14:36257	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-EL–					
4651-Vol.3	14:35954	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-ER–					
6366	14:35532	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-GS–					
6382	14:35959	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6415	14:35955	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
EPRI-GS–					
6419-Vol.3	14:35875	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6438	14:35960	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-NP–					
5675	14:35785	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
5679	14:35786	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6067-Vol.2	14:36095	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6212-M	14:36086	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6295	14:36047	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6337	14:36096	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6386	14:35991	Researach Reports Center, Box 50490, Palo Alto, CA 94300			ND-000
6392-M	14:36544	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6394	14:35992	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6410	14:36007	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6425	14:35767	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPS–					
1988	14:36232	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
3/HA/3	14:35787	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89620395/JAW	MF-000
3/UP/5	14:37168	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
3/UP/5F	14:37169	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
CP(EP)-2	14:35658	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
CP(EP)-3	14:35659	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
ERCB–					
D89-4	14:35683	Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, Canada T2P 3G4; $N/C.			ND-000
ERL–					
87-92(TE)	14:35587	CANMET, 555 Booth St, Ottawa, Canada, K1A OG1			ND-000
ERP/ERL–					
86-56(TR)	14:35588	CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1			ND-000
88-20(TR)	14:35533	CANMET, 555 Booth St., Ottawa, Canada, K1A 0G1			ND-000
ESG–					
46	14:37709	*See* LBL–25609			
ESL–					
ESRF089	14:35661	Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, ON, Canada K1A 0E4; $19.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
ETDE-mf–					
9788047	14:35598	NTIS (US Sales Only), PC A03/MF A01		DE89788047/JAW	MF-000
9788054	14:35534	NTIS (US Sales Only), PC A05/MF A01		DE89788054/JAW	MF-000
9788055	14:36414	NTIS (US Sales Only), PC A03/MF A01		DE89788055/JAW	MF-000
9788064	14:36743	NTIS (US Sales Only), PC A05/MF A01		DE89788064/JAW	MF-000
9788269	14:37170	NTIS (US Sales Only), PC A09/MF A01		DE89788269/JAW	MF-000
9788274	14:35596	NTIS (US Sales Only), PC A03/MF A01		DE89788274/JAW	MF-000
9788276	14:35589	NTIS (US Sales Only), PC A05/MF A01		DE89788276/JAW	MF-000
9788279	14:35903	NTIS (US Sales Only), PC A03/MF A01		DE89788279/JAW	MF-000
ETDE/CA-MS–					
8709	14:35865	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
8903	14:36380	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $ PRICES UPON REQUEST, FUNDS CAN.			ND-000
ETSU-TID–					
4048-P2	14:35949	British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ			ND-000
4055-P2	14:35944	British Library, Boston Spa, Wetherby, West Yorks. LS23 7BQ			ND-000
4059	14:35945	British Library, Boston Spa, Wetherby, West Yorks. LS23 7BQ			ND-000
4061	14:35946	British Library, Boston Spa, Wetherby, West Yorks. LS23 7BQ			ND-000
4062-P1	14:35947	British Library, Boston Spa, Wetherby, West Yorks. LS23 7BQ			ND-000
4066-P1A	14:35950	British Library, Boston Spa, Wetherby, West Yorks. LS23 7BQ			ND-000
4066-P1B	14:35951	British Library, Boston Spa, Wetherby, West Yorks. LS23 7BQ			ND-000
ETSU-WN–					
4055-P1	14:35948	British Library, Boston Spa, Wetherby, West Yorks. LS23 7BQ			ND-000
EUR–					
11729-DE	14:35535				ND-000
EUR-CEA-FC–					
1342	14:37717	NTIS (US Sales Only), PC A07/MF A01			MF-000
1353	14:37760	NTIS (US Sales Only), PC A03/MF A01			MF-000
1354	14:37718	NTIS (US Sales Only), PC A10/MF A01			MF-000
1356	14:37719	NTIS (US Sales Only), PC A03/MF A01			MF-000
FCC–					
068-D-129-P2	14:36674	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
8801	14:35904	Forintek Canada (Ottawa), Montreal Rd., Ottawa, ON, Canada K1S 0W5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
FLOW-TR–					
409	14:36610	*See* AD-A–204630/8/XAB			
FMPC–					
2174	14:35754	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013259/JAW	MF-707
FNAL/C–					
89/104-A	14:37517	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013151/JAW	MF-412
89/112-A	14:37438	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013150/JAW	MF-412
89/115	14:37051	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014170/JAW	MF-414
89/116-T	14:37548	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014814/JAW	MF-414
89/125-T	14:37549	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014815/JAW	MF-414
89/126	14:37074	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014171/JAW	MF-414
FRCEA-TH–					
153	14:36546	NTIS (US Sales Only), PC A07/MF A01		DE89789233/JAW	MF-000
158	14:37577	NTIS (US Sales Only), PC A07/MF A01		DE89789210/JAW	MF-000
182	14:36675	NTIS (US Sales Only), PC A07/MF A01		DE89789256/JAW	MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
FRFF/P–					
88-40	14:36614	*See* AERE-R–13232			
FhG-IWM-W–					
2/88	14:36545	NTIS (US Sales Only), PC A03/MF A01		DE89782878/JAW	MF-000
GA-A–					
19416	14:36871	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014250/JAW	MF-820
19684	14:37761	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014030/JAW	MF-420
GANIL-P–					
88-04	14:37608	NTIS (US Sales Only), PC A03/MF A01		DE89789231/JAW	MF-000
88-16	14:37762	NTIS (US Sales Only), PC A03/MF A01		DE89789225/JAW	MF-000
GANIL-T–					
88-02	14:37601	NTIS (US Sales Only), PC A08/MF A01		DE89789261/JAW	MF-000
89-01	14:37052	NTIS (US Sales Only), PC A05/MF A01		DE89789212/JAW	MF-000
89-02	14:37075	NTIS (US Sales Only), PC A06/MF A01		DE89789213/JAW	MF-000
GAO/NSIAD–					
88-131BR	14:36145	General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			ND-00
GAO/RCED–					
88-103	14:37199	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			ND-00
88-130	14:35831	General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			ND-00
88-60	14:35894	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			ND-00
88-73	14:36146	General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			ND-00
GC-TR–					
88-1416-013	14:35642	*See* AD-A–205006/0/XAB			
GRI–					
89/0068	14:35668	*See* PB–89-173686/XAB			
89/0076	14:35684	*See* PB–89-180160/XAB			
GSI–					
89-33(prepr.)	14:37507	Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)			ND-000
89-36(prepr.)	14:37110	Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)			ND-000
89-40(prepr.)	14:37602	Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)			ND-000
GTFR–					
91	14:37720	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014109/JAW	MF-427
HBBT–					
ESRF093	14:35660	Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, ON, Canada K1A 0E4; $17.50 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
HBI-REF–					
88-4204	14:36261	*See* PB–89-161160/XAB			
HEDL-TME–					
81-30	14:36028	NTIS (US Sales Only), PC A14/MF A01 - OSTI; GPO Dep.	E 1.99:	DE82006332/JAW	PC-539;STD-542
83-12	14:36029	NTIS (US Sales Only), PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013138/JAW	PC-539
HHE–					
73-185-56	14:37186	*See* PB–89-166250/XAB			
74-078-297	14:37185	*See* PB–89-166243/XAB			
75-109-274	14:37182	*See* PB–89-165997/XAB			
75-151-259	14:37184	*See* PB–89-166235/XAB			
75-178-295	14:37183	*See* PB–89-166227/XAB			
HMI-B–					
463	14:37603	NTIS (US Sales Only), PC A03/MF A01		DE89783054/JAW	MF-000
HQ–					
1988-VA	14:36224	Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, Canada H2Z 1A4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
1988-VI	14:36225	Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, Canada H2Z 1A4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
HUTP–					
88/A062	14:37529	*See* NORDITA–89/8-P(prepr.)			
IA–					
170/88	14:37118	*See* OEFZS-A–1350			
IAE–					
4557/15	14:36097	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89620234/JAW	MF-000
IAEA-INFCIRC–					
360	14:35837	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89620442/JAW	MF-000
362	14:36452	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89620443/JAW	MF-000
363	14:36453	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89620444/JAW	MF-000
IAEA-R–					
3512-F	14:36115	NTIS (US Sales Only), PC A06/MF A01 - OSTI;INIS		DE89618248/JAW	MF-000
3695-F	14:37316	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89618050/JAW	MF-000
4434-F	14:37468	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89618367/JAW	MF-000
4531-F	14:37405	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89617881/JAW	MF-000
IAEA-TECDOC–					
503	14:36147	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE89620240/JAW	MF-000
IC–					
88/392	14:37699	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89618379/JAW	MF-000
88/398	14:37700	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89611965/JAW	MF-000
88/424	14:37408	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89619707/JAW	MF-000
89/18	14:37409	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89619708/JAW	MF-000
89/19	14:37609	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89618976/JAW	MF-000
IFVE-OEIUNK/OTF–					
88-65	14:37518	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89618892/JAW	MF-000
IFVE-OLU–					
88-32	14:37053	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89620108/JAW	MF-000
88-33	14:37054	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89620109/JAW	MF-000
IFVE-OMVT–					
88-53	14:37076	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89620137/JAW	MF-000
IJS-DP–					
5041	14:36115	*See* IAEA-R–3512-F			
ILL–					
88CA03G	14:37417	NTIS (US Sales Only), PC A23/MF A01		DE89776438/JAW	MF-000
INFN/BE–					
89/3	14:37620	NTIS (US Sales Only), PC A03/MF A01 - OSTI		DE89013025/JAW	MF-000
INFO–					
0247	14:36098	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89620235/JAW	MF-000
0249	14:36989	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE89620174/JAW	MF-000
0257	14:37641	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89619936/JAW	MF-000
INIS-BR–					
1535	14:36635	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89619612/JAW	MF-000
1539	14:37208	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89619691/JAW	MF-000
1540	14:37209	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89619692/JAW	MF-000
1541	14:37210	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89619693/JAW	MF-000
1542	14:36708	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89619123/JAW	MF-000
1544	14:36709	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89619125/JAW	MF-000
1549	14:37763	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89618739/JAW	MF-000
INIS-SU–					
76	14:36065	NTIS (US Sales Only), PC A06/MF A01; INIS		DE89012164/JAW	MF-000
82	14:37645	NTIS (US Sales Only), PC A09/MF A01		DE89012152/JAW	MF-000
84/A	14:36872	NTIS (US Sales Only), PC A04/MF A01; INIS		DE89012163/JAW	MF-000
85	14:36072	NTIS (US Sales Only), PC A05/MF A01		DE89012154/JAW	MF-000
86/A	14:37712	NTIS (US Sales Only), PC A04/MF A01; INIS		DE89012166/JAW	MF-000
87/A	14:37419	NTIS (US Sales Only), PC A05/MF A01		DE89012157/JAW	MF-000
89	14:37679	NTIS (US Sales Only), PC A10/MF A01; INIS		DE89012153/JAW	MF-000
93	14:36702	NTIS (US Sales Only), PC A06/MF A01		DE89012155/JAW	MF-000
94/A	14:37420	NTIS (US Sales Only), PC A04/MF A01		DE89012156/JAW	MF-000
95	14:36559	NTIS (US Sales Only), PC A04/MF A01; INIS		DE89012167/JAW	MF-000
97	14:36715	NTIS (US Sales Only), PC A16/MF A01		DE89012151/JAW	MF-000
INIS-XN–					
182	14:36155	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE89619908/JAW	MF-000
INIS-mf–					
11438	14:37623	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615781/JAW	MF-000
11440	14:37418	NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS		DE89012158/JAW	MF-000
11445	14:36857	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616655/JAW	MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
11446	14:36116	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE89620265/JAW	MF-000
11448	14:37347	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89616297/JAW	MF-000
11449	14:37788	NTIS (US Sales Only), PC A11/MF A01 - OSTI; INIS		DE89620463/JAW	MF-000
11451	14:36990	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE89618174/JAW	MF-000
11456	14:37678	NTIS (US Sales Only), PC A22/MF A01 - OSTI; INIS		DE89617602/JAW	MF-000
11461	14:37644	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89619925/JAW	MF-000
11462	14:35788	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89620407/JAW	MF-000
11940	14:36149	NTIS (US Sales Only), PC A03/MF A01		DE89788197/JAW	MF-000
11941	14:36150	NTIS (US Sales Only), PC A03/MF A01		DE89788198/JAW	MF-000
11942	14:36151	NTIS (US Sales Only), PC A03/MF A01		DE89788199/JAW	MF-000
11943	14:36152	NTIS (US Sales Only), PC A03/MF A01		DE89788200/JAW	MF-000
11944	14:36153	NTIS (US Sales Only), PC A03/MF A01		DE89788201/JAW	MF-000
11945	14:35789	NTIS (US Sales Only), PC A04/MF A01		DE89788275/JAW	MF-000
11950	14:37299	NTIS (US Sales Only), PC A10/MF A01		DE89788270/JAW	MF-000
11957	14:37318	NTIS (US Sales Only), PC A06/MF A01		DE89788203/JAW	MF-000
11984	14:37355	NTIS (US Sales Only), PC A03/MF A01		DE89788317/JAW	MF-000
11987	14:36676	NTIS (US Sales Only), PC A10/MF A01		DE89788626/JAW	MF-000
INS–					
732	14:37524	NTIS (US Sales Only), PC A03/MF A01		DE89790947/JAW	MF-000
733	14:37445	*See* RRK–89-7			
734	14:37551	NTIS (US Sales Only), PC A03/MF A01		DE89790948/JAW	MF-000
737	14:37525	NTIS (US Sales Only), PC A03/MF A01		DE89790949/JAW	MF-000
IPNO-DRE–					
87-33(7)	14:37471	NTIS (US Sales Only), PC A03/MF A01		DE89781426/JAW	MF-000
87-38	14:37627	NTIS (US Sales Only), PC A03/MF A01		DE89789229/JAW	MF-000
87-40	14:37628	NTIS (US Sales Only), PC A02/MF A01		DE89781508/JAW	MF-000
87-42	14:37629	NTIS (US Sales Only), PC A04/MF A01		DE89781507/JAW	MF-000
88-01	14:37588	NTIS (US Sales Only), PC A03/MF A01		DE89789267/JAW	MF-000
88-02	14:37591	NTIS (US Sales Only), PC A03/MF A01		DE89789264/JAW	MF-000
88-05	14:37578	NTIS (US Sales Only), PC A03/MF A01		DE89781491/JAW	MF-000
88-09	14:37682	NTIS (US Sales Only), PC A03/MF A01		DE89789221/JAW	MF-000
88-17	14:37472	NTIS (US Sales Only), PC A02/MF A01		DE89789223/JAW	MF-000
88-21	14:37630	NTIS (US Sales Only), PC A03/MF A01		DE89789224/JAW	MF-000
88-24	14:37573	NTIS (US Sales Only), PC A02/MF A01		DE89789265/JAW	MF-000
88-31	14:37592	NTIS (US Sales Only), PC A03/MF A01		DE89789268/JAW	MF-000
88-33	14:37593	NTIS (US Sales Only), PC A03/MF A01		DE89789269/JAW	MF-000
88-34	14:37594	NTIS (US Sales Only), PC A03/MF A01		DE89789266/JAW	MF-000
88-37	14:37574	NTIS (US Sales Only), PC A03/MF A01		DE89781599/JAW	MF-000
IPPJ–					
815	14:37728	NTIS (US Sales Only), PC A03/MF A01		DE88780058/JAW	MF-000
822	14:37729	NTIS (US Sales Only), PC A03/MF A01		DE88780060/JAW	MF-000
823	14:37730	NTIS (US Sales Only), PC A03/MF A01		DE88780061/JAW	MF-000
824	14:37731	NTIS (US Sales Only), PC A03/MF A01		DE88780062/JAW	MF-000
826	14:37732	NTIS (US Sales Only), PC A06/MF A01		DE88780063/JAW	MF-000
IPPJ-DT–					
144	14:37804	NTIS (US Sales Only), PC A09/MF A01		DE89790928/JAW	MF-000
IREM–					
86	14:36063	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE89617453/JAW	MF-000
IREQ–					
137-D-374	14:35970	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
180-D-442	14:35971	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
261-T-508	14:35972	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
IRF–					
194	14:37453	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617988/JAW	MF-000
196	14:37454	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617989/JAW	MF-000
ISH–					
123	14:37376	Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
ISN–					
87-87	14:37581	NTIS (US Sales Only), PC A02/MF A01		DE89781514/JAW	MF-000
87-88	14:37589	NTIS (US Sales Only), PC A02/MF A01		DE89781515/JAW	MF-000
88-03	14:37114	NTIS (US Sales Only), PC A03/MF A01		DE89789232/JAW	MF-000
IWR–					
82-H-12	14:35872	*See* AD-A–204796/7/XAB			
IYaF–					
88-24	14:37085	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89620148/JAW	MF-000
JA–					
6147	14:36465	*See* AD-A–205234/8/XAB			
6171	14:36960	*See* AD-A–205233/0/XAB			
JAERI-M–					
88-229	14:37733	NTIS (US Sales Only), PC A03/MF A01		DE89790752/JAW	MF-000
88-261	14:35993	NTIS (US Sales Only), PC A04/MF A01		DE89790959/JAW	MF-000
88-266	14:36021	NTIS (US Sales Only), PC A04/MF A01		DE89790896/JAW	MF-000
88-267	14:36022	NTIS (US Sales Only), PC A03/MF A01		DE89790897/JAW	MF-000
88-271	14:36156	NTIS (US Sales Only), PC A10/MF A01		DE89790899/JAW	MF-000
88-272	14:36855	NTIS (US Sales Only), PC A04/MF A01		DE89790927/JAW	MF-000
89-004	14:36010	NTIS (US Sales Only), PC A07/MF A01		DE89790901/JAW	MF-000
89-006	14:36023	NTIS (US Sales Only), PC A03/MF A01		DE89790943/JAW	MF-000
89-010	14:36038	NTIS (US Sales Only), PC A03/MF A01		DE89790946/JAW	MF-000
JINR–					
13-88-470	14:37086	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89620127/JAW	MF-000
JINR-D–					
17-88-95	14:37702	NTIS (US Sales Only), PC A21/MF A01		DE89012150/JAW	MF-000
JINR-E–					
4-88-543	14:37631	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89618987/JAW	MF-000
JINR-R–					
1-88-331	14:37632	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89619019/JAW	MF-000
1-88-389	14:37598	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89619102/JAW	MF-000
15-88-385	14:37604	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89619108/JAW	MF-000
15-88-386	14:37634	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89619046/JAW	MF-000
15-88-479	14:37115	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89620296/JAW	MF-000
3-88-371	14:37633	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89618988/JAW	MF-000
4-88-532	14:37705	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89618406/JAW	MF-000
5-88-138	14:37552	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89618470/JAW	MF-000
9-88-383	14:37087	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89620135/JAW	MF-000
9-88-416	14:37062	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89620120/JAW	MF-000
Juel–					
2231	14:36024	Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung			ND-000
2244	14:36571	NTIS (US Sales Only), PC A06/MF A01		DE89788399/JAW	MF-000
2249	14:37315	NTIS (US Sales Only), PC A07/MF A01		DE89788398/JAW	MF-000
2257	14:37171	NTIS (US Sales Only), PC A10/MF A01		DE89788343/JAW	MF-000
Juel-Spez–					
475	14:36720	NTIS (US Sales Only), PC A06/MF A01		DE89788344/JAW	MF-000
477	14:36157	NTIS (US Sales Only), PC A06/MF A01		DE89788400/JAW	MF-000
479	14:36247	NTIS (US Sales Only), PC A08/MF A01		DE89788286/JAW	MF-000
K/DSRD–					
80	14:37819	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014831/JAW	MF-000
KEMAKTA-AR–					
88-07	14:37248	*See* SKI–86035			
KFK–					
4399	14:36981	NTIS (US Sales Only), PC A11/MF A01		DE89788353/JAW	MF-000
4491	14:36032	NTIS (US Sales Only), PC A09/MF A01		DE89788355/JAW	MF-000
4501	14:36033	NTIS (US Sales Only), PC A09/MF A01		DE89788354/JAW	MF-000
4563	14:36677	NTIS (US Sales Only), PC A03/MF A01		DE89788424/JAW	MF-000
KIYI–					
88-23	14:37377	NTIS (US Sales Only), PC A03/MF A01; INIS		DE89012162/JAW	MF-000
KURRI-TR–					
309	14:36992	NTIS (US Sales Only), PC A03/MF A01		DE89790848/JAW	MF-000
KVI–					
771	14:37762	*See* GANIL-P–88-16			
LA–					
11294-MS	14:37151	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014844/JAW	MF-742
11422-MS	14:36091	*See* NUREG/CR–5222			
11517-M	14:35768	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014386/JAW	PC-731
11525-MS	14:37137	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014808/JAW	MF-000
11552-MS	14:36459	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013728/JAW	MF-700
11553-MS	14:36456	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013729/JAW	MF-700
11564-MS	14:36454	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013726/JAW	MF-700

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
11577-MS	14:36638	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013656/JAW	MF-365
11598-MS	14:36457	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014572/JAW	MF-700
11601-MS	14:37040	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014261/JAW	MF-000
11614-MS	14:37805	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014164/JAW	MF-705
LA-UR–					
1909	14:37771	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014027/JAW	MF-426
89-1178	14:36158	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011192/JAW	MF-506
89-1241	14:36572	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011181/JAW	MF-704
89-1423	14:36573	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011168/JAW	MF-704
89-1462	14:37685	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011164/JAW	MF-410
89-1558	14:35838	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013210/JAW	MF-700
89-1592	14:37455	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012622/JAW	MF-412
89-1595	14:37456	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012620/JAW	MF-702
89-1605	14:36236	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012616/JAW	MF-000
89-1633	14:35595	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012613/JAW	MF-000
89-1649	14:37595	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013454/JAW	MF-700
89-1745	14:37708	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013436/JAW	MF-414
89-1751	14:37510	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012582/JAW	MF-413
89-1777	14:36639	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013458/JAW	MF-401
89-1811	14:35940	NTIS, PC A03/MF A01 - OSTI		DE89012634/JAW	MF-400
89-1848	14:37457	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012635/JAW	MF-700
89-1871	14:37511	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013464/JAW	MF-700
89-1878	14:35941	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013462/JAW	MF-251
89-1883	14:36844	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014241/JAW	MF-904
89-1892	14:37512	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014239/JAW	MF-414
89-1901	14:37041	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014237/JAW	MF-414
89-1903	14:37042	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014029/JAW	MF-414
89-1905	14:37003	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014028/JAW	MF-706
89-1911	14:37004	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014026/JAW	MF-706
89-1918	14:37526	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014025/JAW	MF-414
89-1928	14:37410	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014024/JAW	MF-703
89-1932	14:36963	NTIS, PC A03/MF A01 - OSTI		DE89014023/JAW	MF-706
89-1941	14:37005	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014259/JAW	MF-706
89-1951	14:37138	NTIS, PC A02/MF A01 - OSTI		DE89014258/JAW	MF-706
89-1956	14:37043	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014257/JAW	MF-414
89-1967	14:37686	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014255/JAW	MF-706
89-1990	14:37006	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014033/JAW	MF-706
89-1992	14:37007	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014034/JAW	MF-706
89-2031	14:35839	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014314/JAW	MF-700
89-2047	14:35840	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014310/JAW	MF-700
89-2059	14:36640	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014308/JAW	MF-704
89-2066	14:35790	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014300/JAW	MF-700
89-2071	14:37089	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014299/JAW	MF-000
89-2080	14:37090	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014298/JAW	MF-706
89-2085	14:37734	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014297/JAW	MF-706
89-2087	14:37806	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014296/JAW	MF-706
89-2088	14:37735	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014295/JAW	MF-426
89-2089	14:37063	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014235/JAW	MF-706
89-2097	14:37008	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014230/JAW	MF-000
89-2106	14:37009	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014227/JAW	MF-706
89-2129	14:35942	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014222/JAW	MF-251
89-2130	14:37807	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014221/JAW	MF-705
89-2137	14:37010	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014220/JAW	MF-000
89-2138	14:36878	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014294/JAW	MF-706
89-2141	14:36641	NTIS, PC A02/MF A01 - OSTI		DE89014292/JAW	MF-704
89-2142	14:36642	NTIS, PC A02/MF A01 - OSTI		DE89014291/JAW	MF-404
89-2144	14:37736	NTIS, PC A02/MF A01 - OSTI		DE89014290/JAW	MF-427
89-2148	14:37139	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014289/JAW	MF-406
89-2151	14:35756	NTIS, PC A02/MF A01 - OSTI		DE89014287/JAW	MF-731
89-2152	14:35757	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014286/JAW	MF-731
89-2162	14:37687	NTIS, PC A03/MF A01 - OSTI		DE89014285/JAW	MF-700
89-2163	14:37011	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014284/JAW	MF-000
89-2164	14:37473	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014282/JAW	MF-000
89-2165	14:37480	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014281/JAW	MF-000
89-2169	14:37012	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014279/JAW	MF-706
89-2187	14:37481	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014277/JAW	MF-706
89-2188	14:37737	NTIS, PC A03/MF A01 - OSTI		DE89014276/JAW	MF-427
89-2194	14:37013	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014274/JAW	MF-000
89-2205	14:37770	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014272/JAW	MF-712
89-489	14:37002	NTIS, PC A02/MF A01 - OSTI		DE89007764/JAW	MF-700
89-965	14:37088	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014244/JAW	MF-700

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
LAL–					
87-10	14:37571	NTIS (US Sales Only), PC A03/MF A01		DE89789228/JAW	MF-000
87-35	14:37575	NTIS (US Sales Only), PC A03/MF A01		DE89789227/JAW	MF-000
88-14	14:37509	NTIS (US Sales Only), PC A02/MF A01		DE89776419/JAW	MF-000
88-29	14:37543	NTIS (US Sales Only), PC A02/MF A01		DE89776424/JAW	MF-000
88-30	14:37553	NTIS (US Sales Only), PC A02/MF A01		DE89776423/JAW	MF-000
88-33	14:37706	NTIS (US Sales Only), PC A03/MF A01		DE89776425/JAW	MF-000
88-34	14:37707	NTIS (US Sales Only), PC A02/MF A01		DE89776421/JAW	MF-000
88-36	14:37544	NTIS (US Sales Only), PC A02/MF A01		DE89776418/JAW	MF-000
88-37	14:37554	NTIS (US Sales Only), PC A02/MF A01		DE89776422/JAW	MF-000
88-41	14:37439	NTIS (US Sales Only), PC A05/MF A01		DE89781520/JAW	MF-000
LANC-R–					
5	14:37155	*See* AD-A–955408/0/XAB			
LBL–					
24944	14:36725	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014159/JAW	MF-246
25363	14:36384	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014891/JAW	MF-920
25559	14:36845	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014904/JAW	MF-401
25609	14:37709	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013369/JAW	PC-414
25686	14:36385	Windows and Daylighting Group, Applied Science Division, Lawrence Berkely Laboratory, 1 Cyclotron Road, Berkeley, CA 94720			ND-350
25831	14:36574	NTIS, PC A03/MF A01		DE89000553/JAW	MF-404
26210	14:37440	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013268/JAW	MF-412;MN-414
26260	14:36258	NTIS, PC A12/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012862/JAW	MF-900
26816	14:36386	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009056/JAW	MF-350
26942	14:36575	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012992/JAW	MF-404
27034	14:36964	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012998/JAW	MF-414
27035	14:36965	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013002/JAW	MF-414
27046	14:36854	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013424/JAW	MF-404
27082	14:36362	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013430/JAW	MF-210
27116	14:37599	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012997/JAW	MF-413
27130	14:36338	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013768/JAW	MF-350
27134	14:37527	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013671/JAW	MF-410
27166	14:36726	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014897/JAW	MF-404;MN-410
27189	14:37064	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012996/JAW	MF-414
27233	14:37441	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014895/JAW	MF-412
27271	14:36576	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014894/JAW	MF-404
LBL-PUB–					
625-Vol.1	14:36248	Glenn T. Seaborg, Lawrence Berkeley Lab., Mail Stop 70-A-3307, 1 Cyclotron Rd., Berkeley, CA 94720			ND-400
625-Vol.2	14:36249	Glenn T. Seaborg, Lawrence Berkeley Lab., Mail-stop 70-A-3307, 1 Cyclotron Rd., Berkeley, CA 94720			ND-400
LLNL–					
9014513	14:36455	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014513/JAW	MF-706
LMSC/F–					
285448	14:37423	*See* AD-A–205182/9/XAB			
LYCEN–					
8754	14:36703	NTIS (US Sales Only), PC A03/MF A01		DE89781494/JAW	MF-000
88-43	14:37116	NTIS (US Sales Only), PC A03/MF A01		DE89789260/JAW	MF-000
Lund-MPh–					
87/06	14:37635	NTIS (US Sales Only), PC A03/MF A01		DE89783600/JAW	MF-000
MEA–					
2311-Rev.1	14:36578	*See* NUREG/CR–5216-Rev.1			
MEW/WS–					
1987	14:35896	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
88-5	14:35895	Manitoba Legislative Library, 200 Vaughan St., Winnipeg, MB, Canada R3C 1T5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
MHD-ITC–					
89-001	14:36346	*See* DOE/PC/90274–T1			
89-002	14:36348	*See* DOE/PC/90274–T3			
89-003	14:36347	*See* DOE/PC/90274–T2			
MICROLOG–					
88-01806	14:36228	*See* DEA–1989			
88-04804	14:35857	*See* EC/WTC–1989			
88-05840	14:37823	*See* SSC/ISD–8805			
88-05971	14:36660	*See* CCL–87081			
88-05971	14:36661	*See* CCL–87082			
88-05995	14:36666	*See* DND/RDB–1/88			
88-06005	14:35682	*See* NEB-SS–GH-2-87			
88-06047	14:37132	*See* CANMET–8801			
88-06056	14:37022	*See* CANMET–8712			
88-06138	14:37283	*See* SU/G–2-86			
88-06153	14:37391	*See* OMNR/FB–87-10			
88-06210	14:35657	*See* AL–86-ALL-07(A-80)			
88-06214	14:35658	*See* EPS–CP(EP)-2			
88-06215	14:35659	*See* EPS–CP(EP)-3			
88-06238	14:37257	*See* EC/IWD–157			
88-06239	14:37392	*See* OMNR/FB–87-11			
88-06240	14:37169	*See* EPS–3/UP/5F			
88-06241	14:37168	*See* EPS–3/UP/5			
88-06242	14:37256	*See* EC/IWD–7			
88-06252	14:37234	*See* EC/NHR/S–88016			
88-06257	14:37024	*See* SC–8706			
88-06350	14:36235	*See* EC–1988			
88-06352	14:37219	*See* EC/IWD–IW/L-AR-WQB-88-143			
88-06474	14:36398	*See* TCI–8705			
88-06476	14:37025	*See* SC–8708			
88-06478	14:36400	*See* UNIES–8712			
89-00132	14:35973	*See* MU/CRT–591			
89-00509	14:35896	*See* MEW/WS–1987			
89-00542	14:35665	*See* NRCC/IMR–29092			
89-00544	14:37172	*See* NRCC/IMR–28908			
89-00548	14:36644	*See* NRCC/IMR–28911			
89-00555	14:36643	*See* NRCC/IMR–28160			
89-00557	14:36728	*See* NRCC/IMR–27559			
89-00580	14:36646	*See* NRCC/IMR–29447			
89-00589	14:36645	*See* NRCC/IMR–29441			
89-00593	14:36679	*See* NRCC–29443			
89-00634	14:36443	*See* BBC–TP-8328-E			
89-00714	14:37235	*See* MNR/FB–88-04			
89-00752	14:35660	*See* HBBT–ESRF093			
89-00754	14:35661	*See* ESL–ESRF089			
89-00755	14:37282	*See* CRSL–ESRF087			
89-00766	14:35904	*See* FCC–8801			
89-00807	14:35873	*See* EC/IWD–1988			
89-00831	14:35655	*See* MU–8708			
89-00886	14:35895	*See* MEW/WS–88-5			
89-00931	14:36232	*See* EPS–1988			
89-00940	14:37395	*See* SCC–8804			
89-00959	14:36240	*See* CANMET–SP88-19			
89-01008	14:36239	*See* CANMET–87-8			
89-01030	14:35907	*See* PNFI–PI-X-85			
89-01171	14:36411	*See* CANMET–5174			
89-01196	14:36224	*See* HQ–1988-VA			
89-01196	14:36225	*See* HQ–1988-VI			
89-01284	14:36260	*See* NEB–23-15			
89-01285	14:36259	*See* NEB–23-15			
89-01396	14:35900	*See* CFS/NF–8710			
89-01929	14:36396	*See* PW–D39			
89-01930	14:36394	*See* PW–1988			
89-01951	14:35730	*See* RPC–420301			
89-01953	14:36469	*See* CANMET–MTL88-78			
89-01977	14:36371	*See* BCH–8809			
89-02005	14:35953	*See* EMR–M91-7/30-1988E			
89-02020	14:36395	*See* PW–D38			
89-02077	14:36234	*See* AE–1-252			
89-02263	14:35865	*See* ETDE/CA-MS–8709			
89-02266	14:35678	*See* OEB–32			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-02307	14:36227	*See* STC/SA–11			
89-02354	14:36229	*See* MU/ES–EC88-01			
89-02446	14:36231	*See* SC/SES–23F			
89-02997	14:36238	*See* ACERR–1989			
89-03973	14:36270	*See* OE–1987			
MLM–					
3590	14:37152	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013740/JAW	PC-704
3592(OP)	14:36678	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014737/JAW	MF-406
3593(OP)	14:37140	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014736/JAW	MF-701
3596	14:36727	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014581/JAW	PC-701
3597	14:36879	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013738/JAW	PC-706
3951(OP)	14:37688	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014734/JAW	MF-704
MML-TR–					
89-12C	14:36461	*See* AD-A–204742/1/XAB			
MNR/FB–					
88-04	14:37235	Manitoba. Manitoba Natural Resources, Public Information Services, 1495 St. James St., PO Box 22, Winnipeg, MB, Canada R3H 0W9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
MPI-PAE/Exp.El.–					
197	14:37117	NTIS (US Sales Only), PC A04/MF A01		DE89788401/JAW	MF-000
MPUB–					
7389	14:35677	Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, MB, Canada R3C 3L6; $N/C.			ND-000
99/89	14:36339	Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, MB, Canada R3C 3L6; $5.00 CAN.			ND-000
MRL-GD–					
0018	14:36220	*See* AD-A–204965/8/XAB			
MRL-R–					
1139	14:36463	*See* AD-A–204962/5/XAB			
1145	14:36464	*See* AD-A–204964/1/XAB			
MTCI–					
10011-RO178	14:35582	*See* DOE/PC/60419–T10			
MTI–					
88-TR-10	14:36577	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012687/JAW	PC-317;STD-317
MU–					
8708	14:35655	Manitoba. Dept. of Consumer and Corporate Affairs, Legislative Bldg., Rm. 104, Winnipeg, MB, Canada R3C 0V8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
MU/CRT–					
591	14:35973	Centre de recherche sur les transports, Universite de Montreal, CP 6128, Succursale A, Montreal, PQ, Canada H3C 3J7; $N/C.			ND-000
MU/ES–					
EC88-01	14:36229	Ont. Min. of Transportation and Communications, R & D Branch, 1201 Wilson Ave., Downsview, ON, Canada M3M 1J8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
NASA-CR–					
182248	14:36448	*See* DOE/NASA–4105-4			
NBI-HE–					
89-17	14:37528	NTIS (US Sales Only), PC A02/MF A01		DE89783574/JAW	MF-000
NDP–					
030	14:37173	*See* ORNL/CDIAC–25			
NEB–					
23-15	14:36259	National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, Canada K1A 0E5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
23-15	14:36260	National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, Canada K1A 0E5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
NEB-SS–					
GH-2-87	14:35682	National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, , Canada K1A 0E5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
NEI-DK–					
167	14:37416	NTIS (US Sales Only), PC A02/MF A01		DE89776127/JAW	MF-000
172	14:36344	NTIS (US Sales Only), PC A05/MF A01		DE89776141/JAW	MF-000
NEI-NO–					
85	14:35656	NTIS (US Sales Only), PC A06/MF A01		DE89776211/JAW	MF-000
NEI-SE–					
35	14:35791	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89618364/JAW	MF-000
NIPER–					
403	14:35664	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000754/JAW	PC-125
NORDITA–					
89/11-P(prepr.)	14:37555	NTIS (US Sales Only), PC A03/MF A01		DE89783576/JAW	MF-000
89/8-P(prepr.)	14:37529	NTIS (US Sales Only), PC A03/MF A01		DE89783575/JAW	MF-000
NOVA–					
1989	14:36255	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $ PRICES UPON REQUEST, FUNDS CAN.			ND-000
NRC–					
9014514	14:36244	NTIS, PC A11/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014514/JAW	MF-113
NRCC–					
29443	14:36679	Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
NRCC/IMR–					
27559	14:36728	Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
28160	14:36643	Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
28908	14:37172	Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
28911	14:36644	Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
29092	14:35665	Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
29441	14:36645	Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
29447	14:36646	Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
NRRI–					
89-11	14:36432	OSTI - National Regulatory Research Institute, Columbus, OH		TI89014121/JAW	MF-000
NSB-QRM–					
1	14:36123	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89618249/JAW	MF-000
2	14:36124	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89618250/JAW	MF-000
NUREG–					
0020-Vol.13-No.5	14:35984	NTIS, PC A22/MF A01 - GPO - OSTI		TI89012989/JAW	MF-000
0750-Vol.29-No.3	14:36048	NTIS, PC A07/MF A01 - GPO - OSTI		TI89013445/JAW	MF-000
0750-Vol.29-No.4	14:36049	NTIS, PC A04/MF A01 - GPO - OSTI		TI89013672/JAW	MF-000
0837-Vol.9-No.1	14:37228	NTIS, PC A10/MF A01 - GPO - OSTI		TI89014155/JAW	MF-000
1331	14:36050	NTIS, PC A18/MF A01 - GPO - OSTI		TI89012988/JAW	MF-000
1349	14:36051	NTIS, PC A06/MF A01 - GPO - OSTI		TI89013819/JAW	MF-000
1354	14:36052	NTIS, PC A - GPO - OSTI		TI89014619/JAW	MF-000
NUREG/CP–					
0098-Vol.1	14:37200	NTIS, PC A99/MF A01 - GPO - OSTI		TI89014647/JAW	MF-502
0098-Vol.2	14:37201	NTIS, PC A99/MF A01 - GPO - OSTI		TI89014648/JAW	MF-502
0098-Vol.3	14:37202	NTIS, PC A19/MF A01 - GPO - OSTI		TI89014649/JAW	MF-502
NUREG/CR–					
3469-Vol.4	14:36159	NTIS, PC A06/MF A01 - GPO - OSTI		TI89013696/JAW	MF-000
4214-Rev.1-Pt.2	14:37380	NTIS, PC A14/MF A01 - GPO - OSTI		TI89014182/JAW	MF-000
4409-Vol.3	14:36160	NTIS, PC A08/MF A01 - GPO - OSTI		TI89014617/JAW	MF-000
4759	14:35792	NTIS, PC A09/MF A01 - GPO - OSTI		TI89014153/JAW	MF-000
4934	14:35841	NTIS, PC A03/MF A01 - OSTI		TI89013484/JAW	ND-000
4961	14:36161	NTIS, PC A05/MF A01 - GPO - OSTI		TI89014713/JAW	MF-000
5216-Rev.1	14:36578	NTIS, PC A06/MF A01 - GPO - OSTI		TI89014236/JAW	MF-000
5222	14:36091	NTIS, PC A03/MF A01 - GPO - OSTI		TI89014212/JAW	MF-000
5227-Suppl.1	14:36162	NTIS, PC A08/MF A01 - GPO - OSTI		TI89014618/JAW	MF-000
5238	14:36579	NTIS, PC A03/MF A01 - GPO - OSTI		TI89014441/JAW	MF-000
5252	14:36163	NTIS, PC A - GPO - OSTI		TI89012985/JAW	MF-000
5291	14:36164	NTIS, PC A03/MF A01 - GPO - OSTI		TI89014625/JAW	MF-000
5347	14:36165	NTIS, PC A08/MF A01 - GPO - OSTI		TI89013675/JAW	MF-000
5350	14:36011	NTIS, PC A04/MF A01 - GPO - OSTI		TI89014475/JAW	MF-000
5352	14:35793	NTIS, PC A14/MF A01 - GPO - OSTI		TI89012767/JAW	MF-000
5363	14:35794	NTIS, PC A07/MF A01 - GPO - OSTI		TI89014104/JAW	MF-000
5375	14:37411	NTIS, PC A04/MF A01 - GPO - OSTI		TI89014733/JAW	MF-000
5379-Vol.1	14:36166	NTIS, PC A04/MF A01 - GPO - OSTI		TI89014805/JAW	MF-000
5389	14:35795	NTIS, PC A07/MF A01 - GPO - OSTI		TI89013677/JAW	MF-000
OE–					
1987	14:36270	Ontario Government Publications, 880 Bay St., 5th Floor, Toronto, ON, Canada M7A 1N8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
OEB–					
32	14:35678	Publications Ontario, 880 Bay St., 5th Floor, Toronto, ON, Canada M7A 1N8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
OEFZS-A–					
1350	14:37118	the Austrian Research Centre Seibersdorf, A-2444 Seibersdorf (Austria)			ND-000
1355	14:36025	the Austrian Research Centre Seibersdorf, A-2444 Seibersdorf (Austria)			ND-000
OH/RD–					
205-D-406	14:35974	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
OMNR/FB–					
87-10	14:37391	Ontario Ministry of Natural Resources, Public Information Centre, 99 Wellesley St., West, Toronto, ON, Canada M7A 1W3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
87-11	14:37392	Ontario. Ministry of Natural Resources. Fisheries Branch, Whitney Block, Room 2347, 99 Wellesley St. W., Toronto, ON, Canada M7A 1W3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
ORNL–					
6525	14:36880	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014570/JAW	MF-407
6526/R4	14:37220	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014569/JAW	MF-600
6541/V1	14:36245	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014568/JAW	MF-400
6542	14:37203	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014567/JAW	MF-000
ORNL/CDIAC–					
25	14:37173	NTIS, PC A99/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013739/JAW	MF-402
ORNL/CON–					
283	14:36370	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013769/JAW	MF-201;MN-234;MN-250
284	14:36338	*See* LBL–27130			
ORNL/DSRD–					
15	14:37820	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014793/JAW	MF-000
ORNL/FTR–					
2880	14:37661	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014054/JAW	MF-402
2942	14:37334	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014059/JAW	MF-407
2945	14:37406	NTIS, PC A03/MF A01 - OSTI		DE89014058/JAW	MF-402
2948	14:35796	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014057/JAW	MF-403
2999	14:37174	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014060/JAW	MF-402
3009	14:37175	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014062/JAW	MF-402
3043	14:37335	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014063/JAW	MF-402
3047	14:37176	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014061/JAW	MF-402
3093	14:36167	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014752/JAW	MF-000
3250	14:37044	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014729/JAW	MF-414
3251	14:36387	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014748/JAW	MF-350
3271	14:37821	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014750/JAW	MF-350
3272	14:37091	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014730/JAW	MF-414
3275	14:37474	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014728/JAW	MF-411
3282	14:35536	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014746/JAW	MF-114
3283	14:35537	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014747/JAW	MF-114
3291	14:36388	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014233/JAW	MF-350
3292	14:36729	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014232/JAW	MF-401
3296	14:36389	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014231/JAW	MF-350
3300	14:35797	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013269/JAW	MF-402
3304	14:35766	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014873/JAW	MF-401
ORNL/M–					
798	14:37759	*See* DOE/ER–0313/5			
ORNL/Sub–					
83-43346/02	14:35538	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014789/JAW	MF-114
88-21642/1	14:35798	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013767/JAW	MF-721
ORNL/TM–					
10569	14:37381	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013765/JAW	MF-000
10714	14:37808	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013730/JAW	PC-700;STD-705
10979	14:37014	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013763/JAW	MF-506
11054	14:35905	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013735/JAW	PC-400
11076	14:36416	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013760/JAW	MF-000
11114	14:36417	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013759/JAW	MF-400
11133	14:36011	*See* NUREG/CR–5350			
11145	14:37320	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013758/JAW	MF-408
11176	14:35539	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013766/JAW	MF-114;MN-103;MN-109
11188	14:36125	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013757/JAW	MF-520
11197	14:35961	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013762/JAW	MF-105;MN-106;MN-114
ORNL/tr–					
89/28	14:36012	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012414/JAW	MF-523
89/31	14:35994	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013796/JAW	MF-523

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
PARAMETER/IE–					
169	14:35841	*See* NUREG/CR–4934			
182	14:36164	*See* NUREG/CR–5291			
PB–					
89-138788/XAB	14:37205	NTIS, PC A04/MF A01			ND-00
89-140883/XAB	14:35687	NTIS, PC A04/MF A01			ND-00
89-142616/XAB	14:36363	NTIS, PC A03/MF A01			ND-00
89-150098/XAB	14:36404	NTIS, PC EE04/MF A01			ND-00
89-150304/XAB	14:36390	NTIS, PC EE05/MF A01			ND-00
89-158752/XAB	14:37302	NTIS, PC EE06/MF A01			ND-00
89-160915/XAB	14:35540	NTIS, PC A07/MF A01			ND-00
89-161160/XAB	14:36261	NTIS, PC A05/MF A01			ND-00
89-162002/XAB	14:37284	NTIS, PC A06/MF A01			ND-00
89-162283/XAB	14:37280	NTIS, PC A04/MF A01			ND-00
89-162366/XAB	14:35515	NTIS, PC EE05/MF E05			ND-00
89-162374/XAB	14:35590	NTIS, PC EE04/MF E04			ND-00
89-163026/XAB	14:36433	NTIS, PC A05/MF A01			ND-00
89-163158/XAB	14:36418	NTIS, PC A23/MF A01			ND-00
89-163430/XAB	14:35575	NTIS, PC A05/MF A01			ND-00
89-163976/XAB	14:36405	NTIS, PC EE05/MF E05			ND-00
89-163984/XAB	14:36406	NTIS, PC EE05/MF E05			ND-00
89-164305/XAB	14:37177	NTIS, PC A10/MF A01			ND-00
89-164560/XAB	14:37178	NTIS, PC A06/MF A01			ND-00
89-164651/XAB	14:37179	NTIS, PC A02/MF A01			ND-00
89-165104/XAB	14:35541	NTIS, PC A03/MF A01			ND-00
89-165237/XAB	14:37180	NTIS, PC A04/MF A01			ND-00
89-165922/XAB	14:37181	NTIS, PC A03/MF A01			ND-00
89-165997/XAB	14:37182	NTIS, PC A03/MF A01			ND-00
89-166227/XAB	14:37183	NTIS, PC A02/MF A01			ND-00
89-166235/XAB	14:37184	NTIS, PC A03/MF A01			ND-00
89-166243/XAB	14:37185	NTIS, PC A03/MF A01			ND-00
89-166250/XAB	14:37186	NTIS, PC A03/MF A01			ND-00
89-166359/XAB	14:37221	NTIS, PC A03/MF A01			ND-00
89-166714/XAB	14:35863	NTIS, PC A03/MF A01			ND-00
89-166722/XAB	14:35858	NTIS, PC A05/MF A01			ND-00
89-166730/XAB	14:35542	NTIS, PC A13/MF A01			ND-00
89-166771/XAB	14:36222	NTIS, PC A03/MF A01			ND-00
89-166961/XAB	14:35576	NTIS, PC EE04/MF E04			ND-00
89-167209/XAB	14:35543	NTIS, PC EE05/MF E03			ND-00
89-167217/XAB	14:35859	NTIS, PC EE04/MF E04			ND-00
89-167282/XAB	14:36444	NTIS, PC EE04/MF E04			ND-00
89-167290/XAB	14:36450	NTIS, PC EE04/MF E04			ND-00
89-167308/XAB	14:36445	NTIS, PC EE04/MF E04			ND-00
89-167316/XAB	14:36446	NTIS, PC EE04/MF E04			ND-00
89-167332/XAB	14:36391	NTIS, PC EE04/MF E04			ND-00
89-167340/XAB	14:36451	NTIS, PC EE04/MF E04			ND-00
89-167365/XAB	14:37222	NTIS, PC EE05/MF E05			ND-00
89-167654/XAB	14:37187	NTIS, PC EE06/MF E06			ND-00
89-168140/XAB	14:37330	NTIS, PC A10/MF A01			ND-00
89-168462/XAB	14:36237	NTIS, PC A17/MF A01			ND-00
89-168728/XAB	14:37188	NTIS, PC A05/MF A01			ND-00
89-169171/XAB	14:37274	NTIS, PC A03			ND-00
89-169262/XAB	14:35562	NTIS, PC A14/MF A01			ND-00
89-169833/XAB	14:37189	NTIS, PC A04/MF A01			ND-00
89-170344/XAB	14:37275	NTISCP T02			ND-00
89-170716/XAB	14:37190	NTIS, PC EE08/MF E08			ND-00
89-170724/XAB	14:37191	NTIS, PC EE07/MF E07			ND-00
89-172183/XAB	14:35563	NTIS, PC A07/MF A01			ND-00
89-172209/XAB	14:36392	NTIS, PC A04/MF A01			ND-00
89-172225/XAB	14:35906	NTIS, PC A11/MF A01			ND-00
89-172274/XAB	14:37192	NTIS, PC A07/MF A01			ND-00
89-173199/XAB	14:35860	NTIS, PC A03/MF A01			ND-00
89-173207/XAB	14:35671	NTIS, PC A05/MF A01			ND-00
89-173264/XAB	14:36262	NTIS, PC A07/MF A01			ND-00
89-173272/XAB	14:36419	NTIS, PC A09/MF A01			ND-00
89-173314/XAB	14:36434	NTIS, PC A10/MF A01			ND-00
89-173579/XAB	14:37321	NTISCP T05			ND-00
89-173587/XAB	14:37322	NTIS, PC A05/MF A01			ND-00
89-173595/XAB	14:35675	NTIS, PC A09/MF A01			ND-00
89-173603/XAB	14:35688	NTIS, PC A07/MF A01			ND-00
89-173629/XAB	14:36364	NTIS, PC A03/MF A01			ND-00

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-173652/XAB	14:36365	NTIS, PC A07/MF A01			ND-00
89-173678/XAB	14:35686	NTIS, PC A03/MF A01			ND-00
89-173686/XAB	14:35668	NTIS, PC A06/MF A01			ND-00
89-174221/XAB	14:36407	NTIS, PC A06/MF A01			ND-00
89-174759/XAB	14:36408	NTIS, PC A09			ND-00
89-175459/XAB	14:37281	NTIS, PC A08/MF A01			ND-00
89-177802/XAB	14:35669	NTIS, PC A06/MF A01			ND-00
89-178164/XAB	14:35680	NTIS, PC A07/MF A01			ND-00
89-178735/XAB	14:35544	NTIS, PC A12/MF A01			ND-00
89-178743/XAB	14:35672	NTIS, PC A10/MF A01			ND-00
89-178784/XAB	14:35861	NTIS, PC A08/MF A01			ND-00
89-179022/XAB	14:36435	NTIS, PC A07/MF A01			ND-00
89-179048/XAB	14:36436	NTIS, PC A09/MF A01			ND-00
89-179055/XAB	14:36437	NTIS, PC A14/MF A01			ND-00
89-179543/XAB	14:36438	NTIS, PC A04/MF A01			ND-00
89-180160/XAB	14:35684	NTIS, PC A07/MF A01			ND-00
89-180921/XAB	14:35591	NTIS, PC A06/MF A01			ND-00
89-180962/XAB	14:36263	NTIS, PC A05/MF A01			ND-00
89-180970/XAB	14:36264	NTIS, PC A06/MF A01			ND-00
89-180988/XAB	14:36265	NTIS, PC A03/MF A01			ND-00
89-180996/XAB	14:36266	NTIS, PC A05/MF A01			ND-00
89-181002/XAB	14:36267	NTIS, PC A06/MF A01			ND-00
89-181010/XAB	14:36268	NTIS, PC A04/MF A01			ND-00
89-181168/XAB	14:35676	NTIS, PC A08/MF A01			ND-00
89-181432/XAB	14:35681	NTIS, PC A99/MF E04			ND-00
89-860191/XAB	14:37331	NTISPC N01/MF N01			ND-00
89-860621/XAB	14:37332	NTISPC N01/MF N01			ND-00
89-860670/XAB	14:37400	NTISPC N01/MF N01			ND-00
89-860688/XAB	14:37323	NTISPC N01/MF N01			ND-00
89-860910/XAB	14:37193	NTISPC N01/MF N01			ND-00
89-861017/XAB	14:37194	NTISPC N01/MF N01			ND-00
89-861058/XAB	14:37393	NTISPC N01/MF N01			ND-00
89-861066/XAB	14:37394	NTISPC N01/MF N01			ND-00
89-861108/XAB	14:36439	NTISPC N01/MF N01			ND-00
89-861116/XAB	14:36440	NTISPC N01/MF N01			ND-00
89-861215/XAB	14:36993	NTISPC N01/MF N01			ND-00
89-861231/XAB	14:36441	NTISPC N01/MF N01			ND-00
89-861348/XAB	14:36447	NTISPC N01/MF N01			ND-00
PDER/BRP–					
9014198	14:35799	NTIS, PC A06/MF A01 - OSTI		DE89014198/JAW	MF-000
PNC-TN–					
8440-88-016	14:35800	NTIS (US Sales Only), PC A03/MF A01		DE89790902/JAW	MF-000
PNFI–					
PI-X-85	14:35907	Petawawa National Forestry Institute, Library, Forestry Canada, Chalk River, ON, Canada K0J 1J0; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
PNL–					
6450-20-HEDR	14:37382	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014546/JAW	MF-707
6560-Vol.1	14:36166	*See* NUREG/CR–5379-Vol.1			
6652-Suppl.1	14:36162	*See* NUREG/CR–5227-Suppl.1			
6797	14:36218	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013764/JAW	MF-202
6821	14:35801	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014795/JAW	MF-721
6822	14:37383	NTIS, PC A15/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014202/JAW	MF-408
6882	14:35802	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014611/JAW	MF-721
6898	14:35803	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014579/JAW	MF-511
6913	14:37662	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013873/JAW	MF-607
6920	14:36226	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014580/JAW	MF-363
6934	14:35856	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014583/JAW	MF-400
6955	14:37276	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014162/JAW	MF-630
PNL-SA–					
15641	14:35804	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014436/JAW	MF-512
16211	14:36580	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014454/JAW	MF-420
16298	14:37663	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014448/JAW	MF-402
16454	14:35805	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014462/JAW	MF-814
16585	14:36393	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014450/JAW	MF-350
16621	14:36846	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014465/JAW	MF-401
16622	14:37141	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014466/JAW	MF-408
16629	14:37142	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014275/JAW	MF-408
16630	14:37143	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014464/JAW	MF-408

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
16743	14:35806	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014461/JAW	MF-510
16782	14:37223	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014453/JAW	MF-702
16839	14:37475	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014463/JAW	MF-401
17006	14:36340	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014457/JAW	MF-350
POEF–					
2007	14:35842	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014234/JAW	MF-507
POEF-T–					
3504	14:35769	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014432/JAW	MF-513
PPPL–					
2623	14:37738	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014600/JAW	PC-426
2625	14:37772	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014602/JAW	PC-420
2628	14:37458	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014603/JAW	PC-427
2630	14:37739	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014601/JAW	PC-420
2631	14:37740	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014598/JAW	PC-427
2634	14:37741	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014606/JAW	PC-427
PW–					
1988	14:36394	Canada. Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
D38	14:36395	Canada. Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
D39	14:36396	Canada. Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
PWR/ASG/P–					
87-9	14:36704	*See* CEGB-TPRD/L–3259/R88			
PWR/HTWG/P–					
88-597	14:36001	*See* CEGB-RD/L–3306/R88			
RAE-TM-Space–					
365	14:37129	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89620339/JAW	MF-000
REPT–					
1273-12	14:36365	*See* PB–89-173652/XAB			
76-H-088/089	14:35681	*See* PB–89-181432/XAB			
RFP–					
4207	14:35758	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014388/JAW	PC-701
4296	14:35843	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014174/JAW	MF-706
4297	14:36994	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013524/JAW	MF-706
4307	14:35844	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014176/JAW	MF-700
RFP-Trans–					
500	14:36581	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012411/JAW	MF-704
RPC–					
420301	14:35730	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
RRK–					
88-40	14:37442	NTIS (US Sales Only), PC A03/MF A01		DE89790890/JAW	MF-000
88-41	14:37556	NTIS (US Sales Only), PC A02/MF A01		DE89790891/JAW	MF-000
89-3	14:37443	NTIS (US Sales Only), PC A03/MF A01		DE89790892/JAW	MF-000
89-4	14:37444	NTIS (US Sales Only), PC A02/MF A01		DE89790893/JAW	MF-000
89-5	14:37557	NTIS (US Sales Only), PC A02/MF A01		DE89790894/JAW	MF-000
89-7	14:37445	NTIS (US Sales Only), PC A02/MF A01		DE89790895/JAW	MF-000
89-9	14:37530	NTIS (US Sales Only), PC A03/MF A01		DE89790940/JAW	MF-000
SAAS–					
368	14:37384	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616656/JAW	MF-000
SAND–					
85-7185-Rev.1-Pt.2	14:37380	*See* NUREG/CR–4214-Rev.1-Pt.2			
86-2325	14:35792	*See* NUREG/CR–4759			
87-1249	14:36582	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014597/JAW	MF-701

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
87-7128	14:36161	*See* NUREG/CR–4961			
88-0624	14:35807	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014594/JAW	MF-814
88-0973C	14:36583	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014490/JAW	MF-704
88-1447	14:36163	*See* NUREG/CR–5252			
88-2294	14:35808	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014596/JAW	MF-814
88-2785	14:35809	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014616/JAW	MF-814
88-2865C	14:36647	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014628/JAW	MF-404
88-2932	14:35975	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014576/JAW	MF-700
88-3037C	14:37482	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012661/JAW	MF-705
88-3041C	14:37809	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013495/JAW	MF-705
88-3057C	14:36881	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013813/JAW	MF-705
88-3089C	14:37810	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005918/JAW	MF-706
88-3153	14:37144	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014578/JAW	MF-700
88-3169C	14:36882	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013809/JAW	MF-706
88-3271	14:36883	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014573/JAW	PC-722
88-3311C	14:37742	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014482/JAW	MF-700
88-3334C	14:36409	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013525/JAW	MF-706
88-3352	14:35810	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014607/JAW	MF-810
88-3360C	14:37092	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013065/JAW	MF-700
88-3437C	14:37773	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013815/JAW	MF-712
88-3439	14:37822	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014595/JAW	MF-705
88-8934	14:36884	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89002536/JAW	MF-700
88-8935	14:36885	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010553/JAW	MF-706
89-0007C	14:37774	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013816/JAW	MF-712
89-0008	14:37811	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014575/JAW	MF-410
89-0025C	14:37483	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014485/JAW	MF-700
89-0037	14:37015	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013884/JAW	MF-410
89-0046C	14:37484	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009333/JAW	MF-705;MN-706
89-0068C	14:37016	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014489/JAW	MF-712
89-0079	14:35943	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013885/JAW	MF-253
89-0133C	14:37145	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008225/JAW	MF-706
89-0155	14:37412	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013332/JAW	MF-252
89-0275C	14:37775	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014495/JAW	MF-712
89-0292C	14:37017	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008227/JAW	MF-700
89-0334C	14:37130	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008111/JAW	MF-706
89-0343C	14:36995	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009969/JAW	MF-704
89-0354C	14:37776	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013064/JAW	MF-712
89-0443C	14:37743	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014188/JAW	MF-712
89-0462	14:35811	NTIS, PC A99/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014586/JAW	MF-813
89-0506C	14:36584	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014550/JAW	MF-404
89-0521	14:36585	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013886/JAW	MF-704
89-0523	14:37093	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014615/JAW	MF-700
89-0542C	14:37689	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013921/JAW	MF-706
89-0665	14:37157	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013879/JAW	MF-707
89-0677C	14:37149	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012570/JAW	MF-741
89-0727	14:36996	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014608/JAW	MF-504
89-0780C	14:37485	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009334/JAW	MF-706
89-0815C	14:36586	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013935/JAW	MF-000
89-0863C	14:37045	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013450/JAW	MF-420
89-0889	14:37402	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014613/JAW	MF-700
89-0894C	14:37777	NTIS, PC A03/MF A01; OSIT; GPO Dep.	E 1.99:	DE89014136/JAW	MF-712
89-1029C	14:37789	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014486/JAW	MF-700
89-1108C	14:37790	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014480/JAW	MF-700
89-1109C	14:37791	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013810/JAW	MF-700
89-1110C	14:35845	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014479/JAW	MF-700
89-1111C	14:35846	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014481/JAW	MF-700
89-1113C	14:36886	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014781/JAW	MF-731
89-1145C	14:37300	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014706/JAW	MF-708
89-1192C	14:37146	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013155/JAW	MF-706
89-1212C	14:36887	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014483/JAW	MF-722
89-1312C	14:36888	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013492/JAW	MF-721;MN-722
89-1346C	14:37690	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013451/JAW	MF-700
89-1366C	14:37413	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014187/JAW	MF-253
89-1385C	14:37023	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013448/JAW	MF-706
89-1390C	14:37778	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012665/JAW	MF-712
89-1402	14:36889	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014571/JAW	MF-706
89-1406C	14:36997	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013164/JAW	MF-706

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-1495C	14:37779	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013567/JAW	MF-712
89-1496C	14:37698	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014630/JAW	MF-411
89-1522C	14:37780	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014177/JAW	MF-712
89-1546C	14:37476	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014488/JAW	MF-704
89-1569C	14:37018	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014487/JAW	MF-700
89-1575C	14:37812	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014780/JAW	MF-731
89-1587C	14:36890	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014186/JAW	MF-706
89-1594C	14:36891	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014629/JAW	MF-706
89-1595C	14:36397	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014172/JAW	MF-700
89-1601C	14:35847	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014070/JAW	MF-700;MN-705
89-1603C	14:35848	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014801/JAW	MF-700;MN-705
89-1604C	14:35849	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014799/JAW	MF-700;MN-705
89-1605C	14:35850	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014803/JAW	MF-700;MN-705
89-1609C	14:37792	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014493/JAW	MF-700
89-1616C	14:36892	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014515/JAW	MF-706
89-1645C	14:35851	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013923/JAW	MF-700
89-7027	14:35926	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013872/JAW	MF-235
89-8241	14:35592	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013908/JAW	MF-113
SC–					
5444.FR	14:36612	*See* AD-A–204687/8/XAB			
8706	14:37024	Canada Mortgage and Housing Corporation, Annex Bldg., 628 Montreal Rd., Ottawa, ON, Canada K1A 0P7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
8708	14:37025	Canada Mortgage and Housing Corporation, Annex Bldg., 628 Montreal Rd., Ottawa, ON, Canada K1A 0P7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
SC/SES–					
23F	14:36231	Statistics Canada, Library, R.H. Coates Bldg., Tunney's Pasture, Ottawa, ON, Canada K1A 0T6; $5.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
SCC–					
8804	14:37395	Science Council of Canada, 100 Metcalfe St., Ottawa, ON, Canada K1P 5M1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
SEATTLE/SWU–					
88/1	14:36434	*See* PB–89-173314/XAB			
SEEDS-DP–					
39	14:36271	British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ			ND-000
SERI/CP–					
213-3495	14:35908	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000895/JAW	MF-270
SERI/SP–					
220-3237	14:35930	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009427/JAW	MF-234
220-3366	14:35909	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000894/JAW	MF-241
320-3396	14:35910	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE88001192/JAW	MF-244
SERI/STR–					
211-3511	14:35911	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009422/JAW	MF-273
211-3519	14:35912	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009437/JAW	MF-273
211-3523	14:35913	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009434/JAW	MF-273
211-3528	14:35914	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009439/JAW	MF-271
SERI/TP–					
217-3505	14:35952	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009443/JAW	MF-261
SFB–					
237-46(prepr.)	14:37710	Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
SKB-TR–					
88-25	14:37414	NTIS (US Sales Only), PC A03/MF A01		DE89783579/JAW	MF-000
SKI–					
86035	14:37248	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89618368/JAW	MF-000
SLAC-PUB–					
4816	14:37513	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013749/JAW	PC-414
4881	14:37531	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013747/JAW	PC-414
4882	14:37065	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013746/JAW	PC-414
4893	14:37094	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013755/JAW	PC-414
4926	14:37095	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013753/JAW	PC-414
4928	14:37066	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013752/JAW	PC-414
4942	14:37119	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014590/JAW	PC-414
4955	14:37532	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014589/JAW	PC-414
4961	14:37096	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014588/JAW	PC-414
4973	14:37533	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014593/JAW	PC-414
4983	14:37534	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013751/JAW	PC-414
4985	14:37514	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014591/JAW	PC-414
4987	14:37535	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014587/JAW	PC-414
SOF–					
202-001	14:35753	*See* CNIC–00147			
SP–					
87-11E	14:35516	Canadian Government Publishing Centre, Ottawa, ON, K1A 0S9 CANMET, 55 Booth St., Ottawa, Ontario, Canada K1A 0G1			ND-000
SSC-TN–					
1200-1	14:36458	*See* AD-A–204880/9/XAB			
SSC/ISD–					
8805	14:37823	New Brunswick Legislative Library, Government Documents Section, 766 King Street, Fredericton, NB, Canada E3B 5H1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
STC/SA–					
11	14:36227	Statistics Canada, Library, R.H. Coates Bldg., Tunney's Pasture, Ottawa, ON, Canada K1A 0T6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
STEV-FBT–					
89-2	14:35593	NTIS (US Sales Only), PC A03/MF A01		DE89776265/JAW	MF-000
89-5	14:35594	NTIS (US Sales Only), PC A03/MF A01		DE89776262/JAW	MF-000
STF–					
21A87099	14:35662	NTIS (US Sales Only), PC A03/MF A01		DE89776218/JAW	MF-000
STUDSVIK-NF-P–					
87-43	14:35995	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617960/JAW	MF-000
STUDSVIK-STSR–					
11	14:35996	NTIS (US Sales Only), PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013236/JAW	MF-523
12	14:36013	NTIS (US Sales Only), PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013237/JAW	MF-523
17	14:35997	NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013242/JAW	MF-523
19	14:35998	NTIS (US Sales Only), PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013244/JAW	MF-523
21	14:35999	NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013246/JAW	MF-523
23-Rev.	14:36093	NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013249/JAW	MF-523
24	14:36000	NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013248/JAW	MF-523
SU–					
7906	14:35862	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages			ND-000
SU/G–					
2-86	14:37283	Indian and Northern Affairs Canada, Reference Centre, Les Terrasses de la Chaudiere, Ottawa, ON, Canada K1A 0H4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
TCI–					
8705	14:36398	Canada Mortgage and Housing Corporation, Annex Bldg., 628 Montreal Rd., Ottawa, ON, Canada K1A 0P7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
TIR–					
440-U-498	14:36399	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
TM–					
88/14	14:37190	*See* PB–89-170716/XAB			
88/16	14:37191	*See* PB–89-170724/XAB			
TR–					
85-87	14:35680	*See* PB–89-178164/XAB			
TR-EL–					
82-4/82(11.100)	14:37249	OSTI - U.S. Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gause Boulevard, Slidell, LA 70458		TI89014108/JAW	MF-000
TTC–					
0891	14:36883	*See* SAND–88-3271			
TVA/OP/EDT–					
88/35	14:35962	NTIS, PC A15/MF A01 - OSTI		DE89014210/JAW	MF-000
TVA/PG/RD–					
88/40	14:35963	NTIS, PC A04/MF A01 - OSTI		DE89014512/JAW	MF-000
TVA/PUB–					
88/16	14:35579	NTIS, PC A03/MF A01 - OSTI		DE89014204/JAW	MF-000
88/17	14:36410	NTIS, PC A03/MF A01 - OSTI		DE89014197/JAW	MF-000
88/18	14:37793	NTIS, PC A04/MF A01 - OSTI		DE89014205/JAW	MF-000
88/19	14:37229	NTIS, PC A06/MF A01 - OSTI		DE89014206/JAW	MF-000
88/20	14:37230	NTIS, PC A06/MF A01 - OSTI		DE89014207/JAW	MF-000
88/21	14:37231	NTIS, PC A07/MF A01 - OSTI		DE89014208/JAW	MF-000
88/22	14:37232	NTIS, PC A03/MF A01 - OSTI		DE89014209/JAW	MF-000
TVA/RDG/EQS–					
89-2	14:35564	NTIS, PC A04/MF A01 - OSTI		DE89014511/JAW	MF-000
TVA/WR/AB–					
89/3	14:36111	NTIS, PC A04/MF A01 - OSTI		DE89014509/JAW	MF-000
89/6	14:35897	NTIS, PC A03/MF A01 - OSTI		DE89014510/JAW	MF-000
TVA/WR/WQ–					
89/1	14:35898	NTIS, PC A04/MF A01 - OSTI		DE89014508/JAW	MF-000
89/2	14:35899	NTIS, PC A03/MF A01 - OSTI		DE89014507/JAW	MF-000
UBA-FB–					
86-062	14:36449	Copy held by UB/TIB Hannover.			MF-000
88-037	14:36420	Copy held by UB/TIB Hannover.			MF-000
UCB-PTH–					
88/26	14:37440	*See* LBL–26210			
UCID–					
16986-89-1	14:35731	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014301/JAW	MF-123
19592-Rev.5	14:36893	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014304/JAW	MF-705
20622-89-1	14:37158	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014303/JAW	MF-701;MN-704
21634	14:37161	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014302/JAW	MF-402
21696	14:37486	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014604/JAW	MF-000
21710	14:36847	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014306/JAW	MF-704
21715	14:36982	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014305/JAW	MF-704
21731	14:37131	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014307/JAW	MF-000
UCLA/PPG–					
1237	14:37744	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014609/JAW	PC-420;STD-421;STD-427
UCRL–					
100268-Rev.1	14:36460	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014036/JAW	MF-700
100356	14:37046	NTIS, PC A02/MF A01 - OSTI		DE89014037/JAW	MF-706
100361	14:37019	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014269/JAW	MF-706
100757	14:36894	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009952/JAW	MF-722
100788	14:36014	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009920/JAW	MF-722
100959	14:37813	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011404/JAW	MF-705

UCRL–

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
100969	14:37147	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013774/JAW	MF-706
100997	14:37488	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013146/JAW	MF-706
101023	14:37781	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013791/JAW	MF-712
101034	14:37814	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013087/JAW	MF-705
101051	14:36998	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013033/JAW	MF-706
101058	14:37153	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013051/JAW	MF-741
101086	14:37605	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014102/JAW	MF-701
101189	14:36587	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013775/JAW	MF-706
101237	14:37815	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014092/JAW	MF-405
101266	14:37782	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014043/JAW	MF-712
21083	14:36848	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014103/JAW	MF-706
21132	14:35939	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014266/JAW	MF-250
21155	14:37487	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014101/JAW	MF-700
21175	14:36233	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014806/JAW	MF-702
21208	14:37159	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014100/JAW	MF-702
52000-89-4	14:37303	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013919/JAW	PC-700
53861-Vol.3	14:37120	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014599/JAW	PC-705
53903	14:37195	NTIS, PC A12/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013887/JAW	MF-402
53922	14:36849	NTIS, PC A13/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014605/JAW	MF-701
98850	14:36966	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014050/JAW	MF-000
99847	14:37636	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014265/JAW	MF-700
99927-Rev.1	14:37196	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014268/JAW	MF-702
UHMET–					
88-01	14:37162	*See* AD-A–204737/1/XAB			
UILU-ENG–					
89-1744	14:37802	*See* DOE/ER/25026–31			
UIUCDCS-R–					
89-1525	14:37802	*See* DOE/ER/25026–31			
UKN–					
54	14:35781	*See* DOE/RW–88.061			
ULRF–					
442/CAR	14:37452	*See* AD-A–205193/6/XAB			
UND-HEP–					
11-29-88	14:37109	*See* DOE/ER/40372–T1			
UNIES–					
8712	14:36400	Canada Mortgage and Housing Corporation, Annex Bldg., 628 Montreal Rd., Ottawa, ON, Canada K1A 0P7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
USGS-BULL–					
1831	14:37407	NTIS, PC A06/MF A01; OSTI - USGS, Federal Center, Box 25425, Denver, CO 80225; GPO Dep.	E 1.99:	DE89014818/JAW	MF-510
USGS-WRI–					
88-4152	14:35938	*See* DOE/ID/12549–1			
UTIAS–					
47	14:37755	*See* CFFTP-G–85041			
WAPD-RC/E(EE)–					
451	14:37204	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013938/JAW	MF-502
WE–					
499/88	14:36025	*See* OEFZS-A–1355			
WHC-EP–					
0165	14:35812	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014200/JAW	MF-702
0182-13	14:35813	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014201/JAW	MF-721
0237	14:35814	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014199/JAW	MF-602
0275	14:35815	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014119/JAW	MF-702
WHC-SA–					
0205	14:36034	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011857/JAW	MF-530
0412	14:36035	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008798/JAW	MF-530
0455	14:36036	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013506/JAW	MF-532
0471	14:35759	NTIS, PC A03/MF A01 - OSTI		DE89013531/JAW	MF-532
0498	14:36037	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013528/JAW	MF-537
0536	14:36588	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011858/JAW	MF-504
0581	14:35745	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013533/JAW	MF-700
WINCO–					
1007	14:35816	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013727/JAW	PC-510
WMATA–					
89-2	14:36408	*See* PB–89-174759/XAB			
WSRC-RP–					
89-288	14:35818	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013770/JAW	MF-721
89-87	14:35817	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013552/JAW	MF-711

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
Y/DW–					
783/R1	14:37121	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014523/JAW	MF-706
Y/TR–					
89/5	14:35760	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014852/JAW	MF-701
89/6	14:35761	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014853/JAW	MF-701
ZE–					
601G569	14:35964	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
601G569	14:35965	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
601G569	14:35966	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
601G569	14:35967	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MENBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000

Order Number Correlation

The correlation list is provided for those organizations that file documents by report number but may receive requests by order number. For more information about a document, refer to the Report Number Index.

Order No.	*Report No.*
DE82006332	HEDL-TME–81-30
DE88001192	SERI/SP–320-3396
DE88780058	IPPJ–815
DE88780060	IPPJ–822
DE88780061	IPPJ–823
DE88780062	IPPJ–824
DE88780063	IPPJ–826
DE89000553	LBL–25831
DE89000754	NIPER–403
DE89000861	DOE/CH/10093–46
DE89000894	SERI/SP–220-3366
DE89000895	SERI/CP–213-3495
DE89000970	DOE/MC/23253–2679
DE89000992	DOE/MC/24219–2705
DE89002536	SAND–88-8934
DE89005918	SAND–88-3089C
DE89007515	CONF-890744–2
DE89007516	CONF-890744–1
DE89007764	LA-UR–89-489
DE89008111	SAND–89-0334C
DE89008225	SAND–89-0133C
DE89008227	SAND–89-0292C
DE89008242	CONF-890721–12
DE89008271	DOE/PC/60419–T10
DE89008305	DP-MS–88-143-Rev.1
DE89008587	DOE/CE/15289–T1
DE89008735	CONF-890721–11
DE89008745	CONF-890721–15
DE89008798	WHC-SA–0412
DE89008921	CONF-890721–14
DE89009056	LBL–26816
DE89009114	CONF-890753–1
DE89009115	DOE/CE/15316–T3
DE89009333	SAND–89-0046C
DE89009334	SAND–89-0780C
DE89009422	SERI/STR–211-3511
DE89009427	SERI/SP–220-3237
DE89009434	SERI/STR–211-3523
DE89009437	SERI/STR–211-3519
DE89009439	SERI/STR–211-3528
DE89009443	SERI/TP–217-3505
DE89009643	CONF-890754–1
DE89009646	EGG-M–88303
DE89009734	EGG-M–88332
DE89009795	DOE/PC/91271–T22
DE89009920	UCRL–100788
DE89009952	UCRL–100757
DE89009969	SAND–89-0343C
DE89010171	CONF-890721–21
DE89010175	DOE/OR/21400–T371
DE89010179	CONF-890721–22
DE89010258	CONF-890721–23
DE89010324	CONF-890721–24
DE89010553	SAND–88-8935
DE89010840	CONF-890721–25
DE89010850	DOE/FC/10618–T1
DE89010877	DOE/ER/13796–3
DE89010980	EGG-M–88448
DE89011131	EGG-M–88406
DE89011164	LA-UR–89-1462
DE89011168	LA-UR–89-1423
DE89011181	LA-UR–89-1241
DE89011192	LA-UR–89-1178
DE89011230	CONF-890771–1
DE89011390	DOE/PC/90508–T8
DE89011404	UCRL–100959
DE89011416	DOE/PC/79856–T1
DE89011526	DOE/ER/13339–5
DE89011577	CONF-890582–1
DE89011857	WHC-SA–0205
DE89011858	WHC-SA–0536
DE89012150	JINR-D–17-88-95
DE89012151	INIS-SU–97
DE89012152	INIS-SU–82
DE89012153	INIS-SU–89
DE89012154	INIS-SU–85
DE89012155	INIS-SU–93
DE89012156	INIS-SU–94/A
DE89012157	INIS-SU–87/A
DE89012158	INIS-mf–11440
DE89012162	KIYI–88-23
DE89012163	INIS-SU–84/A
DE89012164	INIS-SU–76
DE89012166	INIS-SU–86/A
DE89012167	INIS-SU–95
DE89012411	RFP-Trans–500
DE89012414	ORNL/tr–89/28
DE89012418	CONF-8906131–1
DE89012428	CONF-890721–29
DE89012429	CONF-8905175–1
DE89012443	DOE/MC/23077–2696
DE89012483	DOE/PC/81012–T1-Pt.1-A
DE89012510	CONF-890769–2
DE89012570	SAND–89-0677C
DE89012582	LA-UR–89-1751
DE89012613	LA-UR–89-1633
DE89012616	LA-UR–89-1605
DE89012620	LA-UR–89-1595
DE89012622	LA-UR–89-1592
DE89012629	DOE/EIA–M037
DE89012634	LA-UR–89-1811
DE89012635	LA-UR–89-1848
DE89012661	SAND–88-3037C
DE89012665	SAND–89-1390C
DE89012687	MTI–88-TR-10
DE89012698	DOE/ER/40002–T1
DE89012748	DOE/CE/26561–T2
DE89012862	LBL–26260
DE89012866	CONF-8902105–Summs.
DE89012962	DOE/EIA–0109(89/03)
DE89012971	CONF-8904230–1
DE89012972	CONF-890546–7
DE89012974	BNL–42655
DE89012984	CONF-8806136–1
DE89012992	LBL–26942
DE89012996	LBL–27189
DE89012997	LBL–27116
DE89012998	LBL–27034
DE89013002	LBL–27035
DE89013006	CONF-8906137–1
DE89013007	CONF-8903132–3
DE89013024	CONF-890793–1
DE89013025	INFN/BE–89/3
DE89013029	CONF-8906135–1
DE89013033	UCRL–101051
DE89013043	CONF-8905157–1
DE89013046	CONF-890541–1
DE89013047	CONF-890609–5
DE89013050	CONF-8906133–1
DE89013051	UCRL–101058
DE89013053	CONF-8901130–1
DE89013064	SAND–89-0354C
DE89013065	SAND–88-3360C
DE89013083	DOE/PC/79909–6
DE89013087	UCRL–101034
DE89013100	DOE/PC/79914–T5
DE89013103	DOE/PC/88920–T1
DE89013104	DOE/PC/79905–T7
DE89013110	DOE/ET/15601–30
DE89013138	HEDL-TME–83-12
DE89013146	UCRL–100997
DE89013150	FNAL/C–89/112-A
DE89013151	FNAL/C–89/104-A
DE89013155	SAND–89-1192C
DE89013164	SAND–89-1406C
DE89013169	DOE/EIA–0517(89)
DE89013171	CONF-8904232–1
DE89013178	ANL-HEP-CP–89-36
DE89013180	CONF-8905162–1
DE89013186	CONF-8810377–1
DE89013191	CONF-890721–32
DE89013193	CONF-8805296–1
DE89013210	LA-UR–89-1558
DE89013236	STUDSVIK-STSR–11
DE89013237	STUDSVIK-STSR–12
DE89013242	STUDSVIK-STSR–17
DE89013244	STUDSVIK-STSR–19
DE89013246	STUDSVIK-STSR–21
DE89013248	STUDSVIK-STSR–24
DE89013249	STUDSVIK-STSR–23-Rev.
DE89013259	FMPC–2174
DE89013268	LBL–26210
DE89013269	ORNL/FTR–3300
DE89013275	CONF-890785–1
DE89013282	CONF-890604–12
DE89013286	CONF-890565–7
DE89013301	CONF-890790–2
DE89013306	CONF-890721–31
DE89013310	CONF-890792–1
DE89013332	SAND–89-0155
DE89013369	LBL–25609
DE89013424	LBL–27046
DE89013426	CONF-890794–1
DE89013430	LBL–27082
DE89013436	LA-UR–89-1745
DE89013448	SAND–89-1385C
DE89013450	SAND–89-0863C
DE89013451	SAND–89-1346C
DE89013454	LA-UR–89-1649
DE89013458	LA-UR–89-1777
DE89013462	LA-UR–89-1878
DE89013464	LA-UR–89-1871
DE89013492	SAND–89-1312C

Order No.	Report No.
DE89013495	SAND–88-3041C
DE89013505	DOE/PC/90908–T6
DE89013506	WHC-SA–0455
DE89013514	DOE/PC/88886–T2
DE89013516	DOE/PC/88827–T2
DE89013524	RFP–4297
DE89013525	SAND–88-3334C
DE89013528	WHC-SA–0498
DE89013531	WHC-SA–0471
DE89013533	WHC-SA–0581
DE89013536	CONF-8904153–3
DE89013540	CONF-8906148–1
DE89013542	CONF-8906150–1
DE89013550	CONF-8906146–1
DE89013551	CONF-8906147–1
DE89013552	WSRC-RP–89-87
DE89013567	SAND–89-1495C
DE89013568	BNL–42831
DE89013569	BNL–41450
DE89013627	DOE/PETC/TR–89/6
DE89013629	CONF-8807172–1
DE89013639	CONF-8905148–1
DE89013645	CONF-881123–4
DE89013646	CONF-890435–4
DE89013648	CONF-881202–4
DE89013649	CONF-890335–214
DE89013650	CONF-890207–34
DE89013651	CONF-890207–35
DE89013656	LA–11577-MS
DE89013671	LBL–27134
DE89013676	DOE/PC/88801–T2
DE89013678	DOE/ER/40372–T1
DE89013683	DOE/PC/90958–T8
DE89013684	DOE/PC/79907–T5
DE89013704	CONF-8906140–1
DE89013709	CONF-8906144–1
DE89013710	DP-MS–88-185
DE89013726	LA–11564-MS
DE89013727	WINCO–1007
DE89013728	LA–11552-MS
DE89013729	LA–11553-MS
DE89013730	ORNL/TM–10714
DE89013734	DOE/ER–0313/5
DE89013735	ORNL/TM–11054
DE89013738	MLM–3597
DE89013739	ORNL/CDIAC–25
DE89013740	MLM–3590
DE89013746	SLAC-PUB–4882
DE89013747	SLAC-PUB–4881
DE89013749	SLAC-PUB–4816
DE89013751	SLAC-PUB–4983
DE89013752	SLAC-PUB–4928
DE89013753	SLAC-PUB–4926
DE89013755	SLAC-PUB–4893
DE89013757	ORNL/TM–11188
DE89013758	ORNL/TM–11145
DE89013759	ORNL/TM–11114
DE89013760	ORNL/TM–11076
DE89013762	ORNL/TM–11197
DE89013763	ORNL/TM–10979
DE89013764	PNL–6797
DE89013765	ORNL/TM–10569
DE89013766	ORNL/TM–11176
DE89013767	ORNL/Sub–88-21642/1
DE89013768	LBL–27130
DE89013769	ORNL/CON–283
DE89013770	WSRC-RP–89-288
DE89013774	UCRL–100969
DE89013775	UCRL–101189
DE89013782	DOE/PC/90504–T10
DE89013791	UCRL–101023
DE89013796	ORNL/tr–89/31
DE89013803	DOE/ER/45262–T1
DE89013809	SAND–88-3169C
DE89013810	SAND–89-1109C
DE89013813	SAND–88-3057C
DE89013815	SAND–88-3437C
DE89013816	SAND–89-0007C
DE89013823	DOE/IR/05106–T59
DE89013824	DOE/IR/05106–T60
DE89013828	DOE/IR/05106–T63
DE89013831	DOE/IR/05106–T67
DE89013832	DOE/IR/05106–T68
DE89013840	DOE/IR/05106–T76
DE89013842	DOE/IR/05106–T78
DE89013845	DOE/IR/05106–T81
DE89013854	DOE/IR/05106–T89
DE89013871	DOE/CE–0263
DE89013872	SAND–89-7027
DE89013873	PNL–6913
DE89013879	SAND–89-0666
DE89013882	DOE/FE/60457–H4
DE89013883	DOE/EIS–0146D
DE89013884	SAND–89-0037
DE89013885	SAND–89-0079
DE89013886	SAND–89-0521
DE89013887	UCRL–53903
DE89013908	SAND–89-8241
DE89013909	DOE/FE–0135
DE89013911	DOE/FE–0134
DE89013912	DOE/FE–0133
DE89013913	DOE/FE–0132
DE89013919	UCRL–52000-89-4
DE89013921	SAND–89-0542C
DE89013923	SAND–89-1645C
DE89013926	EGG–10617-2015
DE89013931	DOE/ER/03130–5
DE89013935	SAND–89-0815C
DE89013938	WAPD-RC/E(EE)–451
DE89013942	DOE/ER/13281–5
DE89013943	DOE/ER/40374–17
DE89013944	DOE/ER/40374–18
DE89013945	DOE/ER/40374–19
DE89013946	DOE/ER/40374–20
DE89013947	DOE/ER/40374–21
DE89013948	DOE/ER/40374–22
DE89013949	DOE/ER/40374–23
DE89013950	DOE/ER/03130–267
DE89013952	DOE/ER/03130–3
DE89013954	DOE/ER/03130–43C
DE89013955	DOE/ER/03130–44C
DE89013956	DOE/ER/03130–45C
DE89013957	DOE/ER/03130–46C
DE89013958	DOE/ER/03130–48C
DE89013961	DOE/ER/03130–41C
DE89013962	DOE/ER/03130–50C
DE89013963	DOE/ER/03130–425
DE89013964	DOE/ER/45147–4
DE89013965	DOE/ER/13564–7
DE89013967	DOE/ER/60623–1
DE89013968	DOE/ER/13278–2
DE89014023	LA-UR–89-1932
DE89014024	LA-UR–89-1928
DE89014025	LA-UR–89-1918
DE89014026	LA-UR–89-1911
DE89014027	LA-UR–1909
DE89014028	LA-UR–89-1905
DE89014029	LA-UR–89-1903
DE89014030	GA-A–19684
DE89014032	BNL–42627
DE89014033	LA-UR–89-1990
DE89014034	LA-UR–89-1992
DE89014036	UCRL–100268-Rev.1
DE89014037	UCRL–100356
DE89014039	EGG–10617-1033
DE89014043	UCRL–101266
DE89014050	UCRL–98850
DE89014054	ORNL/FTR–2880
DE89014057	ORNL/FTR–2948
DE89014058	ORNL/FTR–2945
DE89014059	ORNL/FTR–2942
DE89014060	ORNL/FTR–2999
DE89014061	ORNL/FTR–3047
DE89014062	ORNL/FTR–3009
DE89014063	ORNL/FTR–3043
DE89014069	CONF-8906112–1
DE89014070	SAND–89-1601C
DE89014076	CONF-890652–1
DE89014078	DOE/EIA–0130(89/04)
DE89014080	CONF-890601–1
DE89014084	ANL/NDM–111
DE89014086	CONF-890627–2
DE89014090	CONF-890403–25
DE89014092	UCRL–101237
DE89014094	CONF-8905143–2
DE89014096	CONF-890703–10
DE89014098	CONF-890618–2
DE89014100	UCRL–21208
DE89014101	UCRL–21155
DE89014102	UCRL–101086
DE89014103	UCRL–21083
DE89014105	ANL/NDM–112
DE89014107	CONF-890403–26
DE89014109	GTFR–91
DE89014111	DOE/EIA–0527(89)
DE89014113	DOE/ER/72027–T2
DE89014116	DOE/PC/90753–T12
DE89014117	DOE/PC/90502–11
DE89014119	WHC-EP–0275
DE89014120	DOE/ER/40124–17
DE89014122	DOE/SF/17714–T1
DE89014123	DOE/ER/40323–T1
DE89014124	DOE/ER/40323–T2
DE89014125	DOE/OR/21697–1
DE89014126	DOE/PC/90274–T1
DE89014129	DOE/PC/90274–T3
DE89014130	DOE/PC/90274–T2
DE89014136	SAND–89-0894C
DE89014154	DOE/EIA–0035(89/03)
DE89014156	DOE/EIA–0109(89/04)
DE89014157	DOE/ID–10204-2
DE89014159	LBL–24944
DE89014162	PNL–6955
DE89014163	ANL/MCS-TM–132
DE89014164	LA–11614-MS
DE89014165	DOE/ER/13576–3
DE89014166	DOE/PC/90507–T11
DE89014168	DOE/ER/40253–148
DE89014169	DOE/ER/25026–31
DE89014170	FNAL/C–89/115
DE89014171	FNAL/C–89/126
DE89014172	SAND–89-1595C
DE89014174	RFP–4296
DE89014176	RFP–4307
DE89014177	SAND–89-1522C
DE89014186	SAND–89-1587C
DE89014187	SAND–89-1366C
DE89014188	SAND–89-0443C
DE89014190	BNL–42803
DE89014192	CONF-851011–10
DE89014193	CONF-8511136–7
DE89014194	CONF-8509443–1
DE89014197	TVA/PUB–88/17
DE89014198	PDER/BRP–9014198
DE89014199	WHC-EP–0237
DE89014200	WHC-EP–0165

Order No.	Report No.
DE89014201	WHC-EP-0182-13
DE89014202	PNL-6822
DE89014204	TVA/PUB-88/16
DE89014205	TVA/PUB-88/18
DE89014206	TVA/PUB-88/19
DE89014207	TVA/PUB-88/20
DE89014208	TVA/PUB-88/21
DE89014209	TVA/PUB-88/22
DE89014210	TVA/OP/EDT-88/35
DE89014214	DOE/PC/88922-T1
DE89014216	DOE/SSDP-0062
DE89014217	DOE/BC/14204-2
DE89014219	DOE/ID/12549-1
DE89014220	LA-UR-89-2137
DE89014221	LA-UR-89-2130
DE89014222	LA-UR-89-2129
DE89014227	LA-UR-89-2106
DE89014230	LA-UR-89-2097
DE89014231	ORNL/FTR-3296
DE89014232	ORNL/FTR-3292
DE89014233	ORNL/FTR-3291
DE89014234	POEF-2007
DE89014235	LA-UR-89-2089
DE89014237	LA-UR-89-1901
DE89014239	LA-UR-89-1892
DE89014241	LA-UR-89-1883
DE89014244	LA-UR-89-965
DE89014250	GA-A-19416
DE89014255	LA-UR-89-1967
DE89014257	LA-UR-89-1956
DE89014258	LA-UR-89-1951
DE89014259	LA-UR-89-1941
DE89014261	LA-11601-MS
DE89014264	BNL-42768
DE89014265	UCRL-99847
DE89014266	UCRL-21132
DE89014268	UCRL-99927-Rev.1
DE89014269	UCRL-100361
DE89014272	LA-UR-89-2205
DE89014274	LA-UR-89-2194
DE89014275	PNL-SA-16629
DE89014276	LA-UR-89-2188
DE89014277	LA-UR-89-2187
DE89014279	LA-UR-89-2169
DE89014281	LA-UR-89-2165
DE89014282	LA-UR-89-2164
DE89014284	LA-UR-89-2163
DE89014285	LA-UR-89-2162
DE89014286	LA-UR-89-2152
DE89014287	LA-UR-89-2151
DE89014289	LA-UR-89-2148
DE89014290	LA-UR-89-2144
DE89014291	LA-UR-89-2142
DE89014292	LA-UR-89-2141
DE89014294	LA-UR-89-2138
DE89014295	LA-UR-89-2088
DE89014296	LA-UR-89-2087
DE89014297	LA-UR-89-2085
DE89014298	LA-UR-89-2080
DE89014299	LA-UR-89-2071
DE89014300	LA-UR-89-2066
DE89014301	UCID-16986-89-1
DE89014302	UCID-21634
DE89014303	UCID-20622-89-1
DE89014304	UCID-19592-Rev.5
DE89014305	UCID-21715
DE89014306	UCID-21710
DE89014307	UCID-21731
DE89014308	LA-UR-89-2059
DE89014310	LA-UR-89-2047
DE89014314	LA-UR-89-2031
DE89014386	LA-11517-M
DE89014388	RFP-4207
DE89014420	BNL-42049
DE89014423	DOE/ER/40150-81
DE89014424	DOE/ER/40150-79
DE89014426	DOE/ER/40150-78
DE89014427	DOE/ER/40150-73
DE89014428	DOE/ER/40150-80
DE89014429	DOE/ER/40150-82
DE89014430	DOE/ER/40150-75
DE89014431	DOE/ER/40150-74
DE89014432	POEF-T-3504
DE89014433	DOE/EIA-M033(87)
DE89014435	DOE/ER/60556-T1
DE89014436	PNL-SA-15641
DE89014437	DOE/PC/90956-T8
DE89014438	DOE/EIA-0523(89/1Q)
DE89014448	PNL-SA-16298
DE89014450	PNL-SA-16585
DE89014452	DOE/CE/15270-T10
DE89014453	PNL-SA-16782
DE89014454	PNL-SA-16211
DE89014457	PNL-SA-17006
DE89014461	PNL-SA-16743
DE89014462	PNL-SA-16454
DE89014463	PNL-SA-16839
DE89014464	PNL-SA-16630
DE89014465	PNL-SA-16621
DE89014466	PNL-SA-16622
DE89014470	DOE/ER/40315-156
DE89014471	DOE/ER/40315-157
DE89014472	DOE/ER/40315-158
DE89014473	DOE/ER/40315-159
DE89014474	DOE/ER/40315-160
DE89014479	SAND-89-1110C
DE89014480	SAND-89-1108C
DE89014481	SAND-89-1111C
DE89014482	SAND-88-3311C
DE89014483	SAND-89-1212C
DE89014485	SAND-89-0025C
DE89014486	SAND-89-1029C
DE89014487	SAND-89-1569C
DE89014488	SAND-89-1546C
DE89014489	SAND-89-0068C
DE89014490	SAND-88-0973C
DE89014493	SAND-89-1609C
DE89014495	SAND-89-0275C
DE89014498	DOE/ER/13544-T2
DE89014499	BNL-42333
DE89014503	DOE/PC/88910-T1
DE89014504	DOE/PC/88925-T1
DE89014505	DOE/PC/90523-T4
DE89014506	DOE/ER/00881-T1
DE89014507	TVA/WR/WQ-89/2
DE89014508	TVA/WR/WQ-89/1
DE89014509	TVA/WR/AB-89/3
DE89014510	TVA/WR/AB-89/6
DE89014511	TVA/RDG/EQS-89-2
DE89014512	TVA/PG/RD-88/40
DE89014513	LLNL-9014513
DE89014514	NRC-9014514
DE89014515	SAND-89-1616C
DE89014518	DOE/PE/70411-T2
DE89014523	Y/DW-783/R1
DE89014524	DOE/NV/10384-26
DE89014525	DOE/SF/16306-15
DE89014527	DOE/ER/45131-7
DE89014528	DOE/ER/40355-T1
DE89014530	DOE/ER/45186-T1
DE89014532	DOE/ER/60290-T2
DE89014534	DOE/ER/03230-T8
DE89014535	DOE/ER/13582-T2
DE89014536	DOE/ER/60399-T2
DE89014537	DOE/ER/45085-T1
DE89014546	PNL-6450-20-HEDR
DE89014550	SAND-89-0506C
DE89014554	DOE/EH/79050-T1
DE89014557	DOE/ER/40004-T2
DE89014559	DOE/PC/88900-4
DE89014562	DOE/ER/40004-T4
DE89014563	DOE/ER/40481-2
DE89014567	ORNL-6542
DE89014568	ORNL-6541/V1
DE89014569	ORNL-6526/R4
DE89014570	ORNL-6525
DE89014571	SAND-89-1402
DE89014572	LA-11598-MS
DE89014573	SAND-88-3271
DE89014575	SAND-89-0008
DE89014576	SAND-88-2932
DE89014578	SAND-88-3153
DE89014579	PNL-6898
DE89014580	PNL-6920
DE89014581	MLM-3596
DE89014582	BNL-52169
DE89014583	PNL-6934
DE89014584	DOE/NASA-4105-4
DE89014586	SAND-89-0462
DE89014587	SLAC-PUB-4987
DE89014588	SLAC-PUB-4961
DE89014589	SLAC-PUB-4955
DE89014590	SLAC-PUB-4942
DE89014591	SLAC-PUB-4985
DE89014593	SLAC-PUB-4973
DE89014594	SAND-88-0624
DE89014595	SAND-88-3439
DE89014596	SAND-88-2294
DE89014597	SAND-87-1249
DE89014598	PPPL-2631
DE89014599	UCRL-53861-Vol.3
DE89014600	PPPL-2623
DE89014601	PPPL-2630
DE89014602	PPPL-2625
DE89014603	PPPL-2628
DE89014604	UCID-21696
DE89014605	UCRL-53922
DE89014606	PPPL-2634
DE89014607	SAND-88-3352
DE89014608	SAND-89-0727
DE89014609	UCLA/PPG-1237
DE89014611	PNL-6882
DE89014613	SAND-89-0889
DE89014614	DOE/RL/01830-H3
DE89014615	SAND-89-0523
DE89014616	SAND-88-2785
DE89014628	SAND-88-2865C
DE89014629	SAND-89-1594C
DE89014630	SAND-89-1496C
DE89014632	CONF-8901115-3
DE89014635	CONF-8905168-1
DE89014639	CONF-890335-209
DE89014642	CONF-890426-21
DE89014643	CONF-890468-11
DE89014659	DOE/PC/88802-T1
DE89014662	DOE/PC/88875-T1
DE89014664	DOE/PC/88875-T2
DE89014676	CONF-8903140-1
DE89014678	CONF-8810118-10
DE89014682	DOE/ER/13584-4
DE89014683	DOE/ER/13411-4
DE89014694	DOE/ER/13603-T1
DE89014700	CONF-881054-Vol.1
DE89014701	CONF-881054-Vol.2
DE89014702	CONF-881054-Vol.3
DE89014703	CONF-881054-Vol.4

Order No.	Report No.
DE89014704	CONF-881054–Vol.5
DE89014706	SAND–89-1145C
DE89014711	BNL-NUREG–42727
DE89014725	DOE/PC/79808–T2
DE89014727	DOE/PC/90521–T10
DE89014728	ORNL/FTR–3275
DE89014729	ORNL/FTR–3250
DE89014730	ORNL/FTR–3272
DE89014734	MLM–3951(OP)
DE89014736	MLM–3593(OP)
DE89014737	MLM–3592(OP)
DE89014746	ORNL/FTR–3282
DE89014747	ORNL/FTR–3283
DE89014748	ORNL/FTR–3251
DE89014750	ORNL/FTR–3271
DE89014752	ORNL/FTR–3093
DE89014758	CONF-8904239–Summ.
DE89014759	CONF-8808146–17
DE89014761	CONF-890619–3
DE89014764	CONF-890673–1
DE89014766	CONF-890659–2
DE89014770	CONF-890659–1
DE89014776	CONF-890673–2
DE89014780	SAND–89-1575C
DE89014781	SAND–89-1113C
DE89014786	DOE/RA/50153–3
DE89014789	ORNL/Sub–83-43346/02
DE89014793	ORNL/DSRD–15
DE89014795	PNL–6821
DE89014797	CONF-8906155–1
DE89014798	DOE/OR/21390–T25
DE89014799	SAND–89-1604C
DE89014801	SAND–89-1603C
DE89014803	SAND–89-1605C
DE89014806	UCRL–21175
DE89014808	LA–11525-MS
DE89014810	DOE/EIA–0520(89/06)
DE89014814	FNAL/C–89/116-T
DE89014815	FNAL/C–89/125-T
DE89014818	USGS-BULL–1831
DE89014826	DOE/EIA–0340(88)/1
DE89014831	K/DSRD–80
DE89014843	DOE/BC/14425–1
DE89014844	LA–11294-MS
DE89014845	DOE/IR/05106–T52
DE89014852	Y/TR–89/5
DE89014853	Y/TR–89/6
DE89014860	DOE/ER/45254–3
DE89014873	ORNL/FTR–3304
DE89014875	CONF-890703–12
DE89014891	LBL–25363
DE89014894	LBL–27271
DE89014895	LBL–27233
DE89014897	LBL–27166
DE89014904	LBL–25559
DE89014909	DOE/IR/05106–T53
DE89014913	DOE/IR/05106–T54
DE89611965	IC–88/398
DE89612602	CBPF-NF–054/88
DE89613061	CNIC–00231
DE89613219	CNIC–00147
DE89613485	CNIC–00214
DE89613763	CNIC–00139
DE89615781	INIS-mf–11438
DE89616297	INIS-mf–11448
DE89616655	INIS-mf–11445
DE89616656	SAAS–368
DE89617453	IREM–86
DE89617602	INIS-mf–11456
DE89617881	IAEA-R–4531-F
DE89617891	CEGB-TPRD/L–3259/R88
DE89617960	STUDSVIK-NF-P–87-43
DE89617988	IRF–194
DE89617989	IRF–196
DE89618050	IAEA-R–3695-F
DE89618174	INIS-mf–11451
DE89618248	IAEA-R–3512-F
DE89618249	NSB-QRM–1
DE89618250	NSB-QRM–2
DE89618364	NEI-SE–35
DE89618366	CEGB-RD/L–3306/R88
DE89618367	IAEA-R–4434-F
DE89618368	SKI–86035
DE89618379	IC–88/392
DE89618406	JINR-R–4-88-532
DE89618470	JINR-R–5-88-138
DE89618739	INIS-BR–1549
DE89618746	CFFTP-G–86045
DE89618772	CFFTP-G–85041
DE89618785	CBPF-NF–060/88
DE89618892	IFVE-OEIUNK/OTF–88-65
DE89618976	IC–89/19
DE89618987	JINR-E–4-88-543
DE89618988	JINR-R–3-88-371
DE89619019	JINR-R–1-88-331
DE89619039	ANU-P–986
DE89619040	ANU-P–988
DE89619046	JINR-R–15-88-386
DE89619102	JINR-R–1-88-389
DE89619108	JINR-R–15-88-385
DE89619123	INIS-BR–1542
DE89619125	INIS-BR–1544
DE89619612	INIS-BR–1535
DE89619691	INIS-BR–1539
DE89619692	INIS-BR–1540
DE89619693	INIS-BR–1541
DE89619706	CNEA-NT–25/87
DE89619707	IC–88/424
DE89619708	IC–89/18
DE89619866	CFFTP-G–87004
DE89619908	INIS-XN–182
DE89619915	CFFTP-G–87005
DE89619917	CNEA-N–2/87
DE89619925	INIS-mf–11461
DE89619936	INFO–0257
DE89620093	CFFTP-G–87013
DE89620108	IFVE-OLU–88-32
DE89620109	IFVE-OLU–88-33
DE89620120	JINR-R–9-88-416
DE89620127	JINR–13-88-470
DE89620135	JINR-R–9-88-383
DE89620137	IFVE-OMVT–88-53
DE89620148	IYaF–88-24
DE89620174	INFO–0249
DE89620211	AECL–8632
DE89620234	IAE–4557/15
DE89620235	INFO–0247
DE89620240	IAEA-TECDOC–503
DE89620265	INIS-mf–11446
DE89620296	JINR-R–15-88-479
DE89620339	RAE-TM-Space–365
DE89620341	DOE/RW–88.061
DE89620395	EPS–3/HA/3
DE89620407	INIS-mf–11462
DE89620442	IAEA-INFCIRC–360
DE89620443	IAEA-INFCIRC–362
DE89620444	IAEA-INFCIRC–363
DE89620445	CNEN-DR-GAPS-RA–01/88
DE89620446	CTA-EAv-CPD-SC–019/81
DE89620447	CTA-EAv-FTE–022/81
DE89620459	CNEA-NT–3/88
DE89620463	INIS-mf–11449
DE89620470	CNEA-NT–6/88
DE89776127	NEI-DK–167
DE89776141	NEI-DK–172
DE89776211	NEI-NO–85
DE89776218	STF–21A87099
DE89776232	BFR-R–97-1988
DE89776238	BFR-R–81-1988
DE89776262	STEV-FBT–89-5
DE89776265	STEV-FBT–89-2
DE89776418	LAL–88-36
DE89776419	LAL–88-14
DE89776421	LAL–88-34
DE89776422	LAL–88-37
DE89776423	LAL–88-30
DE89776424	LAL–88-29
DE89776425	LAL–88-33
DE89776429	CRN-PN–8620
DE89776438	ILL–88CA03G
DE89776469	CEA-DAS–562
DE89776470	CEA-DAS–539e
DE89776471	CEA-CONF–9706
DE89781426	IPNO-DRE–87-33(7)
DE89781491	IPNO-DRE–88-05
DE89781494	LYCEN–8754
DE89781507	IPNO-DRE–87-42
DE89781508	IPNO-DRE–87-40
DE89781514	ISN–87-87
DE89781515	ISN–87-88
DE89781520	LAL–88-41
DE89781564	CEA-DAS–561
DE89781599	IPNO-DRE–88-37
DE89782878	FhG-IWM-W–2/88
DE89783054	HMI-B–463
DE89783574	NBI-HE–89-17
DE89783575	NORDITA–89/8-P(prepr.)
DE89783576	NORDITA–89/11-P(prepr.)
DE89783579	SKB-TR–88-25
DE89783600	Lund-MPh–87/06
DE89788047	ETDE-mf–9788047
DE89788054	ETDE-mf–9788054
DE89788055	ETDE-mf–9788055
DE89788064	ETDE-mf–9788064
DE89788197	INIS-mf–11940
DE89788198	INIS-mf–11941
DE89788199	INIS-mf–11942
DE89788200	INIS-mf–11943
DE89788201	INIS-mf–11944
DE89788203	INIS-mf–11957
DE89788269	ETDE-mf–9788269
DE89788270	INIS-mf–11950
DE89788274	ETDE-mf–9788274
DE89788275	INIS-mf–11945
DE89788276	ETDE-mf–9788276
DE89788277	CONF-8809365–
DE89788279	ETDE-mf–9788279
DE89788286	Juel-Spez–479
DE89788317	INIS-mf–11984
DE89788343	Juel–2257
DE89788344	Juel-Spez–475
DE89788353	KFK–4399
DE89788354	KFK–4501
DE89788355	KFK–4491
DE89788359	DFVLR-FB–89-06
DE89788398	Juel–2249
DE89788399	Juel–2244
DE89788400	Juel-Spez–477
DE89788401	MPI-PAE/Exp.El.–197
DE89788424	KFK–4563
DE89788626	INIS-mf–11987
DE89789210	FRCEA-TH–158
DE89789212	GANIL-T–89-01
DE89789213	GANIL-T–89-02
DE89789221	IPNO-DRE–88-09
DE89789223	IPNO-DRE–88-17

Order No.	Report No.
DE89789224	IPNO-DRE–88-21
DE89789225	GANIL-P–88-16
DE89789226	CRN-PN–8513
DE89789227	LAL–87-35
DE89789228	LAL–87-10
DE89789229	IPNO-DRE–87-38
DE89789231	GANIL-P–88-04
DE89789232	ISN–88-03
DE89789233	FRCEA-TH–153
DE89789234	CRN-HE–85-06
DE89789256	FRCEA-TH–182
DE89789260	LYCEN–88-43
DE89789261	GANIL-T–88-02
DE89789262	CEA-CONF–9767
DE89789264	IPNO-DRE–88-02
DE89789265	IPNO-DRE–88-24
DE89789266	IPNO-DRE–88-34
DE89789267	IPNO-DRE–88-01
DE89789268	IPNO-DRE–88-31
DE89789269	IPNO-DRE–88-33
DE89789270	CRN-VIV–60
DE89789271	CRN-HE–87-08
DE89789272	CRN-PN–8811
DE89789273	CRN-PN–88-02
DE89790752	JAERI-M–88-229
DE89790848	KURRI-TR–309
DE89790890	RRK–88-40
DE89790891	RRK–88-41
DE89790892	RRK–89-3
DE89790893	RRK–89-4
DE89790894	RRK–89-5
DE89790895	RRK–89-7
DE89790896	JAERI-M–88-266
DE89790897	JAERI-M–88-267
DE89790899	JAERI-M–88-271
DE89790901	JAERI-M–89-004
DE89790902	PNC-TN–8440-88-016
DE89790927	JAERI-M–88-272
DE89790928	IPPJ-DT–144
DE89790940	RRK–89-9
DE89790943	JAERI-M–89-006
DE89790946	JAERI-M–89-010
DE89790947	INS–732
DE89790948	INS–734
DE89790949	INS–737
DE89790959	JAERI-M–88-261
TI89012767	NUREG/CR–5352
TI89012985	NUREG/CR–5252
TI89012988	NUREG–1331
TI89012989	NUREG–0020-Vol.13-No.5
TI89013445	NUREG–0750-Vol.29-No.3
TI89013484	NUREG/CR–4934
TI89013672	NUREG–0750-Vol.29-No.4
TI89013675	NUREG/CR–5347
TI89013677	NUREG/CR–5389
TI89013696	NUREG/CR–3469-Vol.4
TI89013819	NUREG–1349
TI89014104	NUREG/CR–5363
TI89014108	TR-EL–82-4/82(11.100)
TI89014121	NRRI–89-11
TI89014153	NUREG/CR–4759
TI89014155	NUREG–0837-Vol.9-No.1
TI89014182	NUREG/CR–4214-Rev.1-Pt.2
TI89014212	NUREG/CR–5222
TI89014236	NUREG/CR–5216-Rev.1
TI89014441	NUREG/CR–5238
TI89014442	EPA–520/5-88-016
TI89014475	NUREG/CR–5350
TI89014544	EPA–520/5-88-019
TI89014585	DOE/IG–0008/10-7
TI89014617	NUREG/CR–4409-Vol.3
TI89014618	NUREG/CR–5227-Suppl.1
TI89014619	NUREG–1354
TI89014625	NUREG/CR–5291
TI89014647	NUREG/CP–0098-Vol.1
TI89014648	NUREG/CP–0098-Vol.2
TI89014649	NUREG/CP–0098-Vol.3
TI89014713	NUREG/CR–4961
TI89014733	NUREG/CR–5375
TI89014805	NUREG/CR–5379-Vol.1
TI89014824	DOE/RW–0225
TI89014825	DOE/RW–0235

CODES USED ON INDEX LINES

Following the citation numbers in the Corporate Author, Personal Author, and Subject Indexes, codes are used to designate the type of document, country of publication, and language of the document, e.g., (R;SU;RU). The language designator does not appear if the document is published in English.

DOCUMENT TYPES

J	Journal article
TJ	Translation of a journal article
R	Report
RA	Report analytic
B	Book
BA	Book analytic
P	Patent
E	Engineering materials
D	Dissertation
TG	Translation (general)
TA	Translation (analytic)

COUNTRY CODES

AD	Andorra
AE	United Arab Emirates
AF	Afghanistan
AL	Albania
AR	Argentina
AT	Austria
AU	Australia
BB	Barbados
BD	Bangladesh
BE	Belgium
BG	Bulgaria
BH	Bahrain
BI	Burundi
BJ	Benin
BM	Bermuda
BO	Bolivia
BR	Brazil
BS	Bahamas
BT	Bhutan
BU	Burma
BW	Botswana
BY	Byelorussian Soviet Socialist Republic (Byelorussian SSR)
CA	Canada
CB	Khmer Republic
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Ivory Coast
CL	Chile
CM	United Republic of Cameroon
CN	China
CO	Colombia
CR	Costa Rica
CS	Czechoslovakia
CU	Cuba
CY	Cyprus
DD	German Democratic Republic
DE	Germany, Federal Republic of (F.R. Germany)
DK	Denmark
DO	Dominican Republic
DZ	Algeria
EC	Ecuador
EG	Egypt
ES	Spain
ET	Ethiopia
FI	Finland
FJ	Fiji
FR	France
GA	Gabon
GB	United Kingdom of Great Britain and Northern Ireland (UK)
GD	Grenada
GH	Ghana
GM	Gambia
GN	Guinea
GQ	Equatorial Guinea
GR	Greece
GT	Guatemala
GU	Guam
GW	Guinea-Bissau
GY	Guyana
HK	Hong Kong
HN	Honduras
HT	Haiti
HU	Hungary
HV	Upper Volta
ID	Indonesia
IE	Ireland
IL	Israel
IN	India
IQ	Iraq
IR	Iran
IS	Iceland
IT	Italy
JM	Jamaica
JO	Jordan
JP	Japan
KE	Kenya
KH	Democratic Kampuchea
KP	Democratic People's Republic of Korea
KR	Korea, Republic of
KW	Kuwait
LA	Laos
LB	Lebanon
LI	Liechtenstein
LK	Sri Lanka
LR	Liberia
LS	Lesotho
LU	Luxembourg
LY	Libyan Arab Republic
MA	Morocco
MC	Monaco
MG	Madagascar
ML	Mali
MN	Mongolia
MR	Mauritania
MT	Malta

MU Mauritius
MV Maldives
MW Malawi
MX Mexico
MY Malaysia

NE Niger
NG Nigeria
NI Nicaragua
NL Netherlands
NO Norway
NP Nepal
NR Nauru
NZ New Zealand

OM Oman

PA Panama
PE Peru
PG Papua New Guinea
PH Philippines
PK Pakistan
PL Poland
PR Puerto Rico
PT Portugal
PY Paraguay

QA Qatar

RH Southern Rhodesia
RO Romania
RW Rwanda

SA Saudi Arabia
SD Sudan
SE Sweden
SG Singapore
SK Sikkim
SL Sierra Leone
SM San Marino
SN Senegal
SO Somalia
SU Union of Soviet Socialist Republics (USSR)
SV El Salvador
SY Syria
SZ Swaziland

TD Chad
TG Togo
TH Thailand
TN Tunisia
TO Tonga
TR Turkey
TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UG Uganda
US United States of America (USA)
UY Uruguay

VA Holy See
VE Venezuela
VI Virgin Islands of the United States
VN Viet Nam

WS Western Samoa

YD Democratic Yemen
YE Yemen
YU Yugoslavia

ZA South Africa
ZM Zambia
ZR Zaire
ZW Zimbabwe

LANGUAGE CODES

BE Belorussian
BU Bulgarian
CH Chinese
CZ Czech
DA Danish
DU Dutch
FI Finnish
FL Flemish
FR French
GE German
HE Hebrew
HI Hindi
HU Hungarian
IR Iranian
IT Italian
JA Japanese
KO Korean
NO Norwegian
PO Polish
PT Portuguese
RN Rumanian
RU Russian
SC Serbo-Croatian
SE Slovene
SP Spanish
SV Slovak
SW Swedish
TH Thai
TU Turkish
UK Ukrainian
VT Vietnamese

☆U. S. GOVERNMENT PRINTING OFFICE: 1989/648-118/00009

ORDER FORM

DOE and DOE contractors: Fill in Parts I, II, and IV. **Others:** Fill in Parts I, III, and IV. Mark appropriate blanks in Part IV to indicate quantity and form (microfiche or paper copy).

I. SHIPPING AND PAYMENT INFORMATION

Ordering Address

Name _____ Telephone _____

Address _____

City _____ State _____ ZIP _____

Shipping Address (if different from above)

Name _____

Address _____

City _____ State _____ ZIP _____

_____

SIGNATURE (Required to validate ALL orders)

II. OSTI ORDERS (DOE and DOE contractors can order from OSTI.)

☐ Charge OSTI deposit account no. _____

Mail orders to: U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

III. NTIS ORDERS

☐ Charge NTIS deposit account no. _____

☐ Check/Money Order enclosed for $ _____

☐ Charge to my ☐ American Express ☐ VISA ☐ MasterCard

_____ _____
Account Number Card expiration date

☐ Ship & Bill (see below for restrictions)
Employer identification number (9 digits) __ __ - __ __ __ __ __ __ __

Purchase Order number _____

Phone number of billing office _____
(Required for Ship & Bill orders)

Ship & Bill service is restricted to North American business locations for an extra $7.50 per order (or per Custom Search). The business' employer identification number plus the phone number of the office paying the bill are required to process these requests. A late payment charge will be applied to billings more than 30 days overdue. Prepaying, using an NTIS Deposit Account or a charge account, speeds order processing. Be sure payment and order are sent together. Checks, payable to NTIS, must be in U.S. dollars.

Mail orders to: U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

IF NO METHOD OF PAYMENT IS INDICATED, YOUR ORDER WILL BE RETURNED TO YOU AS A PRICE QUOTE UNPROCESSED.

IV. SELECTIONS

Order number _____ Report number _____

Abstract number (with vol., issue) _____

No. of fiche _____ No. of paper copies _____

Order number _____ Report number _____

Abstract number (with vol., issue) _____

No. of fiche _____ No. of paper copies _____

Order number _____ Report number _____

Abstract number (with vol., issue) _____

No. of fiche _____ No. of paper copies _____

Order number _____ Report number _____

Abstract number (with vol., issue) _____

No. of fiche _____ No. of paper copies _____

Order number _____ Report number _____

Abstract number (with vol., issue) _____

No. of fiche _____ No. of paper copies _____

Order number _____ Report number _____

Abstract number (with vol., issue) _____

No. of fiche _____ No. of paper copies _____

CUT OUT APPROPRIATE FORM AND MAIL IN A STAMPED ENVELOPE TO THE ADDRESS INDICATED.

Change of Address Form

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

PLEASE PRINT OR TYPE

(or) COUNTRY

MAIL THIS FORM TO:

NEW ADDRESS
Superintendent of Documents
Government Printing Office SSOM
Washington, D.C. 20402

Attach last subscription label here.

Subscription Order Form

Enter my Subscription to: _____

(Please indicate publication)

@ $_____ Domestic; @ $_____ Foreign.

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

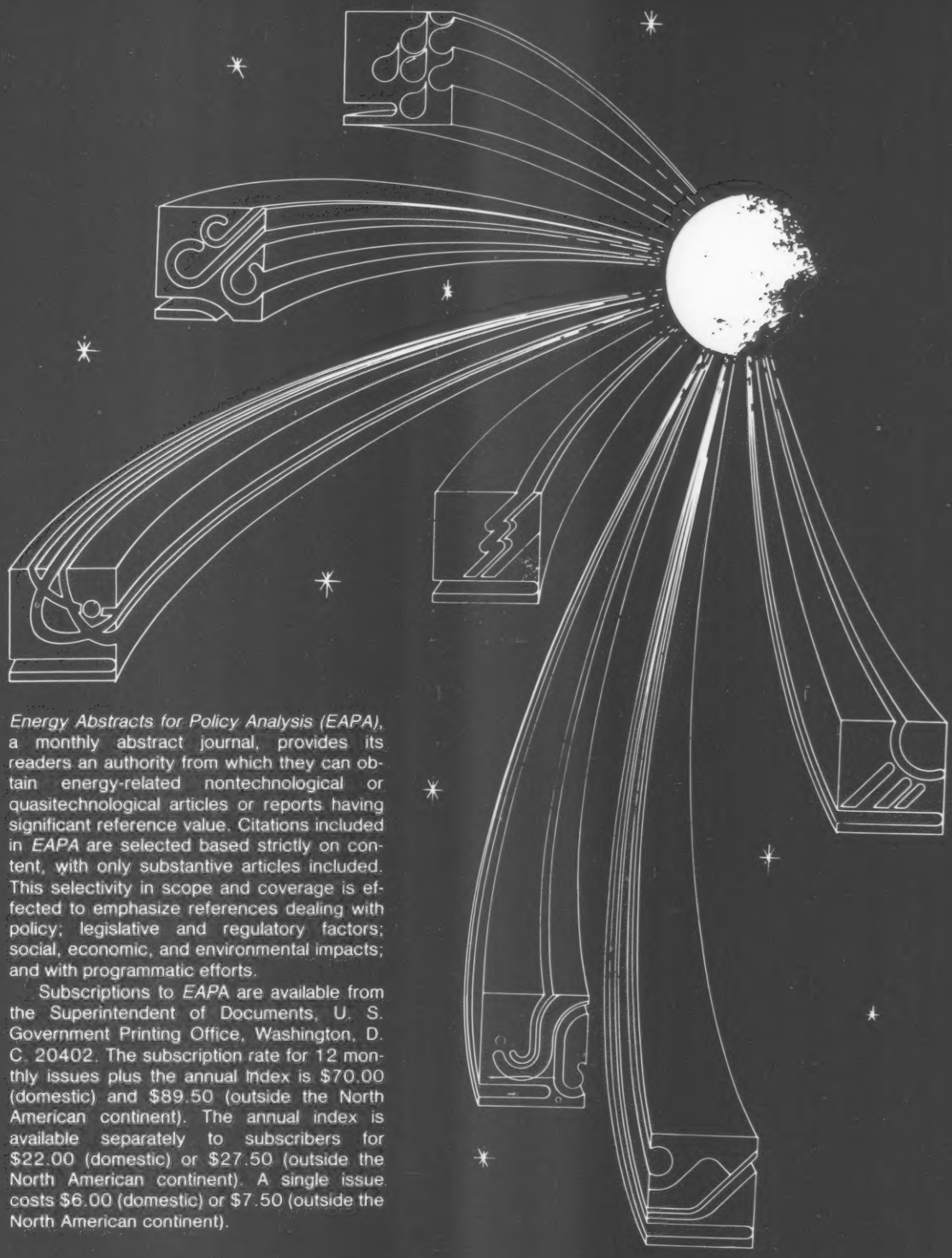
PLEASE PRINT OR TYPE

(or) COUNTRY

☐ Remittance Enclosed (Make checks payable to Superintendent of Documents)

☐ Charge to my Deposit Account No._____

MAIL ORDER FORM TO:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402



Energy Abstracts for Policy Analysis (EAPA), a monthly abstract journal, provides its readers an authority from which they can obtain energy-related nontechnological or quasitechnological articles or reports having significant reference value. Citations included in *EAPA* are selected based strictly on content, with only substantive articles included. This selectivity in scope and coverage is effected to emphasize references dealing with policy; legislative and regulatory factors; social, economic, and environmental impacts; and with programmatic efforts.

Subscriptions to *EAPA* are available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for 12 monthly issues plus the annual index is $70.00 (domestic) and $89.50 (outside the North American continent). The annual index is available separately to subscribers for $22.00 (domestic) or $27.50 (outside the North American continent). A single issue costs $6.00 (domestic) or $7.50 (outside the North American continent).

FEDERAL DEPOSITORY LIBRARY PROGRAM

As a result of an agreement between the U. S. Government Printing Office (GPO) and the Department of Energy, beginning in 1984 DOE reports with unlimited distribution are now included in the Federal Depository Library Program. The Regional Depository Libraries listed below receive and retain at least one copy of nearly every Federal Government publication, either in printed or microfilm form, for use by the general public. These libraries provide reference services and interlibrary loans; however, they are *not* sales outlets. You may wish to ask your local library to contact a Regional Depository to help you locate specific publications, or you may contact the Regional Depository yourself. Do not send checks or orders to these libraries.

ARKANSAS STATE LIBRARY
One Capitol Mall
Little Rock, AR 72201
(501) 371-2326

AUBURN UNIV. AT MONTGOMERY LIBRARY
Documents Department
Montgomery, AL 36193
(205) 279-9110, ext. 253

UNIV. OF ALABAMA LIBRARY
Documents Dept.-Box S
University, AL 35486
(205) 348-7369

DEPT. OF LIBRARY, ARCHIVES AND PUBLIC RECORDS
Third Floor-State Cap.
1700 West Washington
Phoenix, AZ 85007
(602) 255-4121

UNIVERSITY OF ARIZONA LIB.
Governments Documents Dept.
Tucson, AZ 85721
(602) 626-5233

CALIFORNIA STATE LIBRARY
Govt. Publications Section
P.O. Box 2037
Sacramento, CA 95809
(916) 322-4572

UNIV. OF COLORADO LIB.
Government Pub. Division
Campus Box 184
Boulder, CO 80309
(303) 492-8834

DENVER PUBLIC LIBRARY
Govt. Pub. Department
1357 Broadway
Denver, CO 80203
(303) 571-2131

CONNECTICUT STATE LIBRARY
Government Documents Unit
231 Capitol Avenue
Hartford, CT 06106
(203) 566-4971

UNIV. OF FLORIDA LIBRARIES
Library West
Documents Department
Gainesville, FL 32611
(904) 392-0367

UNIV. OF GEORGIA LIBRARIES
Government Reference Dept.
Athens, GA 30602
(404) 542-8951

UNIV. OF HAWAII LIBRARY
Govt. Documents Collection
2550 The Mall
Honolulu, HI 96822
(808) 948-8230

UNIV. OF IDAHO LIBRARY
Documents Section
Moscow, ID 83843
(208) 885-6344

ILLINOIS STATE LIBRARY
Information Services Branch
Centennial Building
Springfield, IL 62706
(217) 782-5185

INDIANA STATE LIBRARY
Serials Documents Section
140 North Senate Avenue
Indianapolis, IN 46204
(317) 232-3686

UNIV. OF IOWA LIBRARIES
Govt. Documents Department
Iowa City, IA 52242
(319) 353-3318

UNIVERSITY OF KANSAS
Doc. Collect.-Spencer Lib.
Lawrence, KS 66045
(913) 864-4662

UNIV. OF KENTUCKY LIBRARIES
Govt. Pub. Department
Lexington, KY 40506
(606) 257-3139

LOUISIANA STATE UNIVERSITY
Middleton Library
Govt. Docs. Dept.
Baton Rouge, LA 70803
(504) 388-2570

LOUISIANA TECHNICAL UNIV. LIBRARY
Documents Department
Ruston, LA 71272
(318) 257-4962

UNIVERSITY OF MAINE
Raymond H. Fogler Library
Tri-State Regional Documents Depository
Orono, ME 04469
(207) 581-1680

UNIVERSITY OF MARYLAND
McKeldin Lib.-Doc. Div.
College Park, MD 20742
(301) 454-3034

BOSTON PUBLIC LIBRARY
Government Docs. Dept.
Boston, MA 02117
(617) 536-5400 ext. 226

DETROIT PUBLIC LIBRARY
Sociology Department
5201 Woodward Avenue
Detroit, MI 48202
(313) 833-1409

MICHIGAN STATE LIBRARY
P.O. Box 30007
Lansing, MI 48909
(517) 373-0640

UNIVERSITY OF MINNESOTA
Government Pubs. Division
409 Wilson Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 373-7813

UNIV. OF MISSISSIPPI LIB.
Documents Department
University, MS 38677
(601) 232-5857

UNIV. OF MONTANA
Mansfield Library
Documents Division
Missoula, MT 59812
(406) 243-6700

NEBRASKA LIBRARY COMM.
Federal Documents
1420 P Street
Lincoln, NE 68508
(402) 471-2045
(in cooperation with University of Nebraska-Lincoln)

UNIVERSITY OF NEVADA LIB.
Govt. Pub. Department
Reno, NV 89557
(702) 784-6579

NEWARK PUBLIC LIBRARY
5 Washington Street
Newark, NJ 07101
(201) 733-7812

UNIVERSITY OF NEW MEXICO
Zimmerman Library
Government Pub. Dept.
Albuquerque, NM 87131
(505) 277-5441

NEW MEXICO STATE LIBRARY
Reference Department
325 Don Gaspar Avenue
Santa Fe, NM 87501
(505) 827-2033, ext. 22

NEW YORK STATE LIBRARY
Empire State Plaza
Albany, NY 12230
(518) 474-5563

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
Wilson Library
BA/SS Documents Division
Chapel Hill, NC 27515
(919) 962-1321

UNIVERSITY OF NORTH DAKOTA
Chester Fritz Library
Documents Department
Grand Forks, ND 58202
(701) 777-2617, ext. 27
(in cooperation with North Dakota State Univ. Library)

STATE LIBRARY OF OHIO
Documents Department
65 South Front Street
Columbus, OH 43215
(614) 462-7051

OKLAHOMA DEPT. OF LIBRARIES
Government Documents
200 NE 18th Street
Oklahoma City, OK 73105
(405) 521-2502

OKLAHOMA STATE UNIV. LIB.
Documents Department
Stillwater, OK 74078
(405) 624-6546

PORTLAND STATE UNIV. LIB.
Documents Department
P.O. Box 1151
Portland, OR 97207
(503) 229-3673

STATE LIBRARY OF PENN.
Government Pub. Section
P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

TEXAS STATE LIBRARY
Public Services Department
P.O. Box 12927-Cap. Sta.
Austin, TX 78753
(512) 471-2996

TEXAS TECH. UNIV. LIBRARY
Govt. Documents Department
Lubbock, TX 79409
(806) 742-2268

UTAH STATE UNIVERSITY
Merrill Library, U.M.C. 30
Logan, UT 84322
(801) 750-2682

UNIVERSITY OF VIRGINIA
Alderman Lib.-Public Doc.
Charlottesville, VA 22901
(804) 924-3133

WASHINGTON STATE LIBRARY
Documents Section
Olympia, WA 98504
(206) 753-4027

WEST VIRGINIA UNIV. LIB.
Documents Department
Morgantown, WV 26506
(304) 293-3640

MILWAUKEE PUBLIC LIBRARY
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-3000

ST. HIST. LIB. OF WISCONSIN
Government Pub. Section
816 State Street
Madison, WI 53706
(608) 262-4347

WYOMING STATE LIBRARY
Supreme Ct. & Library Bld.
Cheyenne, WY 82002
(307) 777-6344

Order Number Correlation	Report Number Index	Contract Number Index	Subject Index	Personal Author Index	Corporate Author Index